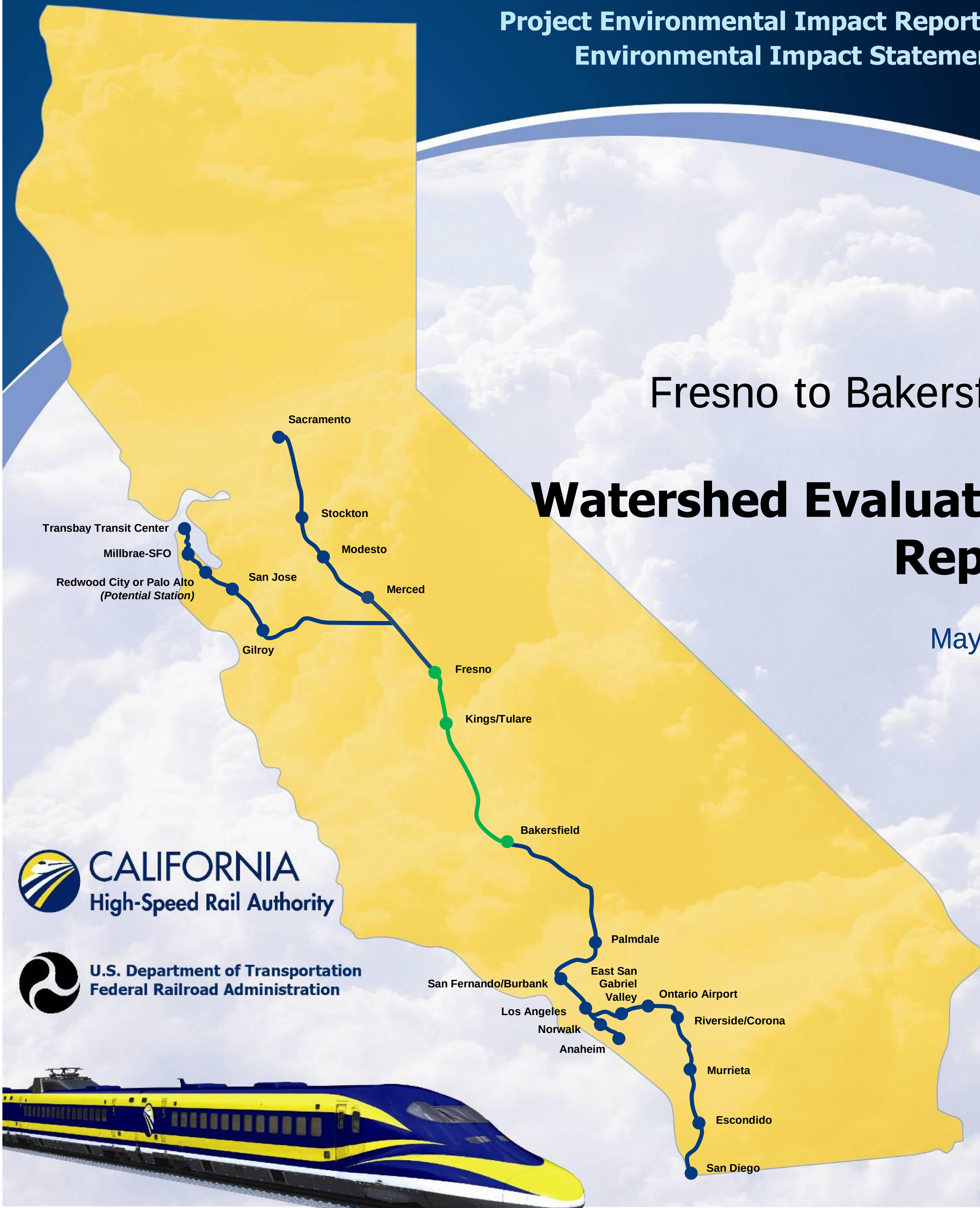
# Appendix 3.7-C
## Watershed Evaluation Report

# CALIFORNIA HIGH-SPEED TRAIN

**Project Environmental Impact Report / Environmental Impact Statement**




## Fresno to Bakersfield

# Watershed Evaluation Report

May 2013

CALIFORNIA
High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROJECT

# Watershed Evaluation Report

*Prepared by:*

URS/HMM/Arup Joint Venture

May 2013

Please Note: The wetland delineation data referenced in this report is consistent with the data presented in *Fresno to Bakersfield Revised Draft EIR / Supplemental Draft EIS.* Since the preparation of this report, minor changes to the wetland delineation have been made, resulting in small changes to the extent (acreages) and types of special aquatic resources occurring in the Fresno to Bakersfield Wetland Study Area. These changes are based on recommendations and guidance from the U.S. Army Corps of Engineers (USACE) and were included in interim deliverables to USACE in August and October 2012. A final wetland delineation revision package including additional changes was submitted to USACE in January 2013 and resulted in the issuance of a Preliminary Jurisdictional Determination by the USACE on February 5, 2013. A summary of the modifications to special aquatic resources since the publication of the Revised Draft EIR/Supplemental Draft EIS is provided in Table A.

Changes to special aquatic resources since the preparation of the Revised Draft EIR/Supplemental Draft EIS include the following:

- Revised the extent of ditches, canals, retention/detention basins, a small portion of the Kings River, and vernal pools along the Fresno to Bakersfield alignment based on updated aerial imagery.
- Added ditches, canals, seasonal wetlands and ditches along the Fresno to Bakersfield alignment based on updated aerial imagery.
- Added vernal pools in the Allensworth area, along the BNSF Alternative and the Allensworth Bypass Alternative.
- Removed ditches, retention/detention basins, and seasonal wetlands along the Fresno to Bakersfield alignment that no longer exist based on updated aerial imagery.
- Changed large, linear vernal pools and vernal swales and one ditch to seasonal wetlands and changed one vernal swale to a ditch. These changes generally occurred in the BNSF right-of-way between Corcoran and Allensworth.

Because these changes were made after the preparation of this report and the associated Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report, they are not reflected in this document. Revisions to the wetland delineation as covered by the Preliminary Jurisdictional Delineation may occur as a result of additional engineering changes to the Fresno to Bakersfield alignment. Any such changes will be incorporated into the Final EIR/EIS.

**Table A**
Modifications to Fresno-Bakersfield Special Aquatic Resources in the Wetland Study Area[a]

| **Special Aquatic Resource** | **RDEIR/SDEIS[b] (June 2012)** | **Interim Deliverable (Aug 2012)** | **Interim Deliverable (Oct 2012)** | **PJD (Feb 2013)** |
|---|---|---|---|---|
| Emergent Wetland | 0.92 | 0.92 | 0.92 | 0.92 |
| Seasonal Wetland | 43.56 | 43.44 | 73.05 | 74.46 |
| Vernal Pool | 77.90 | 72.05 | 52.46 | 68.00 |
| Vernal Swale | 17.96 | 16.40 | 5.71 | 4.86 |
| *Total Wetlands* | *140.34* | *132.81* | *132.14* | *148.24* |
| Canal/Ditch | 199.55 | 206.21 | 205.92 | 207.53 |
| Reservoir | 117.58 | 117.58 | 117.58 | 117.58 |
| Retention/detention Basin | 160.75 | 159.71 | 159.24 | 156.00 |
| Seasonal Riverine | 58.33 | 56.73 | 56.73 | 56.26 |
| *Total Other Waters of the U.S.* | *536.20* | *540.23* | *539.47* | *537.36* |
| **Special Aquatic Resources Total[c]** | **676.54** | **673.04** | **671.61** | **685.60** |

Notes:

[a] Wetland Study Area includes linear and auxiliary project construction features (i.e., TPSS, switching stations, paralleling stations, road overcrossings, heavy maintenance facilities) plus a 250-foot buffer.

[b] Based on the Supplemental PJWWDR (June 2012)

[c] This total is derived from raw GIS data. As a result, it may not exactly equal the sum of the rounded values presented in the table.

Acronym:
TPSS = traction power supply station

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## Tables

## Figures

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## Acronyms

| | |
|---|---|
| 2008 Mitigation Rule | "Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 230) |
| AA | assessment area |
| Allensworth ER | Allensworth Ecological Reserve |
| Authority | California High-Speed Rail Authority |
| CDFG | California Department of Fish and Game |
| C.F.R. | Code of Federal Regulations |
| cfs | cubic feet per second |
| CRAM | California Rapid Assessment Method |
| EIR/EIS | Environmental Impact Report/Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | federal Endangered Species Act |
| F.R. | Federal Register |
| FRA | Federal Railroad Administration |
| GIS | Geographic Information System |
| HST | high-speed train |
| HUC-8 | Hydrologic Unit Code 8 |
| Kern NWR | Kern National Wildlife Refuge |
| LEDPA | Least Environmentally Damaging Practicable Alternative |
| MOU | *NEPA/404/408 Memorandum of Understanding* |
| NHD | National Hydrography Dataset |
| NRCS | Natural Resources Conservation Service |
| Pixley NWR | Pixley National Wildlife Refuge |
| SR | State Route |
| TWG | Technical Working Group |
| USACE | U.S. Army Corps of Engineers |
| U.S.C. | United States Code |
| USGS | U.S. Geological Survey |
| USFWS | U.S. Fish and Wildlife Service |

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# Executive Summary

# Executive Summary

A watershed-level analysis of aquatic resources for the Fresno to Bakersfield Section of the California High-Speed Train (HST) System (project) has been developed in conformance with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) April 10, 2008 "Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (2008 Mitigation Rule) (33 Code of Federal Regulations [C.F.R.] Parts 325 and 332 and 40 C.F.R. Part 230) and California's Level 1-2-3 framework for wetland monitoring and assessment. Also, as required by the *NEPA/404/408 Memorandum of Understanding* (MOU) between the Federal Railroad Administration (FRA), California High-Speed Rail Authority (Authority), EPA, and USACE, dated November 2010 (FRA et al. 2010), a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S." has been conducted to assist in the analysis of impacts. The goal of the MOU is to facilitate compliance with the National Environmental Policy Act (42 United States Code [U.S.C.] Section 4321 *et seq.),* Section 404 of the Clean Water Act (33 U.S.C. Section 1344), and Section 14 of the Rivers and Harbors Act (33 U.S.C. Section 408) process for the project-level (Tier 2) Environmental Impact Statement for the project. The integration process comprises three "checkpoints," which punctuate ongoing coordination efforts. The three checkpoints are:

A. Definition of purpose and need for the Tier 2 HST project.

B. Identification of the Range of Alternatives to be studied in the project (Tier 2) Environmental Impact Report / Environmental Impact Statement (EIR/EIS).

C. Preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) Determination; USACE Section 408 Draft Response; and Draft Mitigation Plan consistent with 33 Code of Federal Regulations (C.F.R.) Part 332 and 40 C.F.R. Part 230 (73 Federal Register [F.R.] 19,593, dated April 10, 2008).

This document provides information in support of the Checkpoint C Preliminary LEDPA Determination as it relates to Section 404 of the Clean Water Act. Several Technical Working Group (TWG) meetings occurred to coordinate and communicate technical issues and clarifications regarding the application of the watershed approach, including the Level 1-2-3 assignment of condition values to aquatic features and identification of direct impacts, indirect impacts, and post-project conditions and their application in determining the LEDPA. Two notable directives were produced from the Technical Working Group meetings, one referring to the concept of developing watershed profiles for each particular watershed unit that would be affected by the Fresno to Bakersfield Section and the other referring to the impact assessment framework for the MOU Checkpoint C Preliminary LEDPA Determination and the Section 404(b)(1) determination process.

This report is designed to provide an analysis for the USACE of the extent and quality of wetlands and other jurisdictional features present within the watersheds in which the Fresno to Bakersfield Section of the HST System occurs. The purpose of this evaluation is to provide the USACE information regarding the extent and quality of aquatic resources present in the study areas and the extent to which these features would be affected by the construction and operation of the Fresno to Bakersfield Section. The effect on existing functions and services is analyzed by alignment alternative and design option so that the USACE and can use the data in their determination of the LEDPA.

The proposed project is to construct and operate an HST rail line from Fresno to Bakersfield. The *Fresno to Bakersfield Revised Draft EIR / Supplemental Draft EIS* evaluates 10 alternatives, including the No Project Alternative, the BNSF Alternative and the Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter

Bypass, Bakersfield South, and Bakersfield Hybrid alternatives. Of the nine Fresno to Bakersfield HST Alternatives (excluding the No Project Alternative), one alternative, the BNSF Alternative, spans the entire project length, from Fresno to Bakersfield. The remaining eight alternative alignments deviate from the BNSF Alternative for portions of the route to avoid environmental, land use, or community impacts.

# ES1.0 Methods

This Watershed Evaluation Report for the Fresno to Bakersfield Section discusses the methods and analysis used to develop a watershed profile, identifies the existing conditions of the aquatic resources, quantifies direct and indirect impacts on aquatic resources, and estimates the post-project condition of aquatic resources. In some instances, the data used were developed in part at a national or statewide level by others (e.g., the U.S. Fish and Wildlife Service, the U.S. Geological Survey). The Level 1 Watershed Profile uses a number of national and statewide or regional databases to estimate the type, distribution, extent (quantity), and condition of the aquatic resources in each watershed. This information helps identify the regional setting of the aquatic resource impacts expected to occur as part of the implementation of the project.

Direct and indirect impacts are conservatively estimated by overlaying the construction and project footprints on the results of the wetland delineation (Authority and FRA 2012g). The construction and project footprints were used to identify direct impacts, and a 250-foot buffer around the footprints (study area) was used to calculate indirect impacts to adjacent aquatic resources. The existing conditions of the aquatic resources were determined by a two-step process: (1) conducting a site-specific assessment using the California Rapid Assessment Method (CRAM) on a sample of aquatic features that are representative of the types of features found in the study area; and (2) extrapolating the results of the CRAM assessment and assigning a relative condition (i.e., poor, fair, good, or excellent) to all aquatic features. Quantifying impacts, assessing the condition of aquatic resources, and extrapolating the conditions of aquatic features constitute the Level 2 Impact Evaluation.

The model for estimating the post-project conditions of the aquatic resources affected by implementation of the project was developed based on a set of generated projections. The projections used and extrapolated post-project conditions based on the type of aquatic resource affected, the location within the construction or project footprints, the type of impact (direct or indirect), and the existing relative condition. A similar set of projections were generated to assess the risk (low, moderate, or high) of loss or change to aquatic resources as a result of indirect impacts.

# ES2.0 Aquatic Resources

A number of aquatic resources were identified in the study area, including federal-jurisdictional wetlands, other waters of the U.S., and riparian areas. Identified wetland features include seasonal wetlands, emergent wetlands, and vernal pools and swales. Other waters of the U.S. identified in the study area include canals/ditches, lacustrine, and seasonal riverine. Additionally, riparian areas, that are generally found in association with seasonal riverine features, were identified and are discussed with aquatic resources because of the important functions they provide that affect water quality, including groundwater recharge, surface water supply, nutrient cycling, water filtration, temperature control, maintenance of plant and animal communities, sediment transport and storage, stream channel dynamic equilibrium, and streambank stabilization. Many of the jurisdictional waters in the study area have been leveled, drained, and/or leveed for agricultural purposes (to prevent flooding).

The physical and biological characteristics of the various features are largely dictated by whether the feature is manipulated or natural. Manipulated features include all jurisdictional water features except vernal pools and swales. Manipulated features contain substrates that have been altered through excavation, filling, dredging, or accretion of sediments; these substrates typically range from sandy and coarse-loamy to fine-silty, fine-loamy, and fines (depending on location in the study area). Natural features such as vernal pools and swales have substrates composed of natural alkaline soils, which are harsh environments for microbes and plants and contain low levels of organic matter.

## ES3.0 Level 1 Watershed Profile

The Fresno to Bakersfield Section is located in the Tulare Lake Basin; specifically the project is located in seven U.S. Geological Survey HUC-8 sub watersheds basins:

- Upper Dry Watershed (18030009)
- Tulare–Buena Vista Lakes Watershed (18030012)
- Upper Kaweah Watershed (18030007)
- Upper Tule Watershed (18030006)
- Upper Deer–Upper White Watershed (18030005)
- Upper Poso Watershed (1803004)
- Middle Kern–Upper Tehachapi–Grapevine Watershed (1803003)

All of these watersheds are in the Tulare Lake Basin, which covers a large and diverse area in California. The profiles of each of the watersheds within the areas of the Fresno to Bakersfield Section alternatives share many similarities across the Tulare Lake Basin. All of the watersheds are characterized by mostly protected headwaters. In the Sierra Nevada Foothills and the Mountains and the Coast Ranges ecological sections, the impacts that degrade the quality of the aquatic features are mostly dams and associated reservoirs. Proportionally within each watershed, these ecological sections do not contribute nearly as much acreage and linear feet of aquatic features as does the Great Valley ecological section.

Throughout the Tulare Lake Basin and across all the watersheds in the study area, the valley has largely been manipulated through agriculture, transportation and urban development. These conversions have resulted in the loss, manipulation, and degradation of aquatic resources through upper watershed impoundments, removal of riparian vegetation, and other hydrological manipulations. These activities have largely resulted in the extensive reduction of riparian habitat, the accretion of streams, and the loss of Tulare Lake, Buena Vista Lake, and Kern Lake as well as an extensive loss of other sensitive aquatic features (i.e., vernal pools and swales).

Furthermore, the historical and current land use patterns have blurred the boundaries of the watersheds through the construction of an extensive network of irrigation canals and ditches. Due to the north-south orientation and linear nature of the Fresno to Bakersfield Section, impacts to aquatic features occur across all seven watersheds. However, most of the Fresno to Bakersfield alternatives have relatively small footprints within a few different watersheds.

The Fresno to Bakersfield Section occurs entirely within the Great Valley ecological section. The project impact profile and the subsequent compensatory mitigation are similar across all seven watersheds, except perhaps the Upper Deer–Upper White Watershed. The Upper Deer–Upper White Watershed contains a significantly greater area of vernal pool landscapes and should be a focus of compensatory mitigation efforts.

The 2008 Mitigation Rule states a preference for mitigation using a watershed approach, but acknowledges that for linear projects, where impacts are distributed across multiple watersheds, more ecological functions and values may be created, enhanced, or restored in fewer consolidated mitigation projects. Because of the degraded condition of aquatic resources in the region, the focus of compensatory mitigation will be on consolidated mitigation projects because they provide the best opportunity to benefit the region. The mitigation may also be consolidated in the watersheds that would experience significant ecological loss of aquatic resources in excellent or good condition.

# ES4.0 Level 2 Impact Evaluation

The Level 2 Impact Evaluation describes the impacts to aquatic resources, identifies the existing conditions of those resources, estimates their post-project condition, summarizes the details of a Compensatory Mitigation Plan to offset the negative effects, and discusses the overall net condition of the associated watersheds. The evaluation is conducted for each of the proposed Fresno to Bakersfield alternatives. The impact profile has three components: direct-permanent impacts, direct-temporary impacts (in areas where the impact would occur only during construction), and indirect (and indirect-bisected) permanent impacts adjacent to the construction and project footprint (within a 250-foot buffer).

Impacts are presented in a manner that allows for a comparison of the HST alternative alignments (Table ES-1). Under the BNSF Alternative, the acreage reflects the total impact that would occur along the only end-to-end alternative. To compare the other project alternatives and design options, the table contains two numbers for each of these other alternatives: the first number is the impact acreage anticipated for the given alternative; the second number is the change (or delta) when compared against the corresponding segment of the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in more impact acres than its corresponding segment of the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in fewer impact acres than its corresponding segment of the BNSF Alternative.

The impact evaluation provides an analysis of the project impacts based on watershed and alternative alignment. The data suggest that certain alignment alternatives will either reduce or increase the project's impacts to aquatic resources. In some instances, one alternative may increase impacts to one type of feature, but reduce impacts to another type of feature or condition classification. These evaluations primarily focus on direct-permanent impacts to aquatic features that are natural, are hard to replace, or are in fair to excellent condition. The information provided in the main body of the report provides an evaluation for all features, in all condition classifications (poor, fair, good, and excellent), for all types of impacts (direct-permanent, direct-temporary, indirect-bisected, and indirect). However, for the purpose of the Executive Summary, the evaluation only covers the total impacts based on the type of impact and the total impacts based on the condition.

In general, the focus is first and foremost on impacts to aquatic resources that are in excellent or good condition, secondarily on impacts to aquatic resources in fair condition, and lastly on impacts to aquatic resources in poor condition. Similarly, impacts that are direct-permanent are more severe than those that are direct-temporary, indirect-bisected, or indirect. Additional analysis of other environmental resources and impacts (e.g., other biological resources, cultural resources, important farmland) and evaluation with respect to cost, logistics, and technology should be conducted when evaluating and selecting the LEDPA.

**Table ES-1**
Summary Comparison of Direct-Permanent and Other Impacts on Aquatic Resources by Alternative

| Wetlands and Other Waters (TYPE/HST water type) | Impact Type /Feature Type [a] | Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BNSF Impact Acreage | Hanford West Bypass 1—At-Grade Option | Hanford West Bypass 1—Below-Grade Option | Hanford West Bypass 2—At-Grade Option | Hanford West Bypass 2—Below-Grade Option | Corcoran Elevated | Corcoran Bypass | Allensworth Bypass | Wasco-Shafter Bypass | Bakersfield South | Bakersfield Hybrid |
| | | | Impact Acreage / Difference Compared with Corresponding BNSF Area [b] | | | | | | | | | |
| **Total Impacts by Impact Type and Alternative** | | | | | | | | | | | | |
| Total Impacts | Direct-Permanent | 100.95 | 16.47 / +2.20 | 15.02 / +0.75 | 13.03 / -1.24 | 11.57 / -2.70 | 15.04 / -6.13 | 14.00 / -7.17 | 23.70 / -15.01 | 4.78 / -3.28 | 5.39 / -0.18 | 6.08 / +0.52 |
| | Direct-Temporary | 13.01 | 1.44 / +0.85 | 1.44 / +0.85 | 1.54 / +0.96 | 1.54 / +0.96 | 0.90 / +0.02 | 5.18 / +4.31 | 2.72 / +1.20 | 1.16 / -1.46 | 3.92 / -0.22 | 3.89 / -0.25 |
| | Indirect-Bisected | 23.88 | — | — | — | — | 4.76 / -0.73 | — / -5.49 | 1.73 / -15.52 | — | — | — |
| | Indirect | 361.16 | 43.41 / -5.66 | 36.47 / -12.61 | 55.01 / +5.93 | 48.06 / -1.01 | 36.27 / +9.21 | 28.47 / +1.41 | 154.68 / -31.78 | 12.34 / -7.21 | 32.87 / -14.05 | 32.28 / -14.64 |
| Total Impacts to Poor Aquatic Resources | | 274.84 | 44.15 / +14.77 | 36.71 / +7.32 | 41.40 / +12.01 | 33.95 / +4.57 | 44.56 / +2.54 | 38.64 / -3.38 | 102.47 / -8.74 | 18.28 / -11.94 | 23.83 / -2.18 | 23.90 / -2.11 |
| Total Impacts to Fair Aquatic Resources | | 128.37 | 7.17 / +2.45 | 6.22 / +1.49 | 18.18 / +13.46 | 17.23 / +12.50 | 12.39 / -0.17 | 8.99 / -3.57 | 71.53 / -25.01 | — | — / -0.86 | — / -0.86 |
| Total Impacts to Good Aquatic Resources | | 94.26 | 10.00 / -19.82 | 10.00 / -19.82 | 10.00 / -19.82 | 10.00 / -19.82 | 0.01 / 0.00 | 0.01 / 0.00 | 8.83 / -25.84 | — | 18.35 / -11.41 | 18.35 / -11.41 |
| Total Impacts to Excellent Aquatic Resources | | 1.53 | — | — | — | — | — | — | — / -1.53 | — | — | — |

**Table ES-1**

Summary Comparison of Direct-Permanent and Other Impacts on Aquatic Resources by Alternative

| Wetlands and Other Waters (TYPE/HST water type) | Impact Type /Feature Type [a] | Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BNSF Impact Acreage | Hanford West Bypass 1—At-Grade Option | Hanford West Bypass 1—Below-Grade Option | Hanford West Bypass 2—At-Grade Option | Hanford West Bypass 2—Below-Grade Option | Corcoran Elevated | Corcoran Bypass | Allensworth Bypass | Wasco-Shafter Bypass | Bakersfield South | Bakersfield Hybrid |
| | | | Impact Acreage / Difference Compared with Corresponding BNSF Area [b] | | | | | | | | | |

Notes:

— = No impact or not applicable

[a] Indirect impacts are calculated within a 250-foot buffer of the project footprint, which includes areas of permanent and temporary impacts.

[b] The "Difference Compared with Corresponding BNSF Area" represents the difference in impact acreages between an alternative alignment and its corresponding segment in the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in more impact acres than its corresponding segment in the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in fewer impact acres than its corresponding segment in the BNSF Alternative.

Impact calculations in this table include alignment alternatives and station alternatives, but do not include the heavy maintenance facility (HMF) site alternatives.

All impacts were calculated based on the 15% engineering design construction footprint.

# ES5.0 Compensatory Mitigation

Compensatory mitigation for adverse impacts to aquatic resources will be determined in consultation with the USACE and in part through the assessment of aquatic resource conditions that would be lost or impaired through construction and operation of the Fresno to Bakersfield Section of the HST System. Compensatory mitigation will preserve, create, and/or enhance aquatic resource conditions, functions, values, and services.

The compensatory mitigation should focus on improving conditions within watersheds where the linear project has the most significant detriment, where opportunities for improvement are present, and where the mitigation can provide the greatest benefit to the overall condition of the watershed. The latter can be implemented by focusing mitigation efforts on restoring historically predominant and valuable aquatic resources in the landscape that have been lost over time, namely Tulare Lake and its associated emergent wetlands. Though not impacted by this project, the historical loss of Tulare Lake to development and land conversion represents the greatest aquatic habitat loss in the Central Valley. Therefore, restoration of Tulare Lake through compensatory mitigation would greatly benefit watershed condition.

Because the watershed profile and impact evaluation identified significant vernal pools and swales in the Upper Deer–Upper White Watershed, compensatory mitigation should focus on maintaining or improving these features and the overall conditions in this watershed. Other watersheds that have significant areas of vernal pools and swales in good condition—and therefore present an opportunity for improvement that should be considered for vernal pool compensatory mitigation—include the Upper Dry, Tulare–Buena Vista Lakes, Upper Kaweah, and Upper Tule watersheds. Compensatory mitigation for impacts to seasonal riverine features could occur in any of the identified watersheds because these features are present in all watersheds. Out-of-kind mitigation should focus on creation or restoration of Tulare Lake and historical emergent wetlands. Selection of compensatory mitigation sites should focus on areas where there is connectivity to protected lands, up-stream stressors are absent or reduced, and opportunities for stream and riparian habitat enhancement or restoration are available.

To date, several permittee-responsible mitigation options have been identified that may be suitable to partially or fully mitigate potential impacts to aquatic resources. Five potential mitigation sites containing aquatic features have been identified. Other properties are currently being considered and will be evaluated when the potential for mitigation has been analyzed in more detail. Suitable opportunities exist to satisfy mitigation obligations in the potential permittee-responsible mitigation properties and in unidentified areas within the project watersheds.

# ES6.0 Summary

From the detailed evaluation of the Level 1 Watershed Profile and the results of the Level 2 Impact Evaluation, several conclusions are apparent. The conclusions of the Level 1 Watershed Profile are affirmed by the Level 2 Impact Evaluation, both in terms of the conditions in the watersheds and the land uses identified in the watersheds. The themes identified in the Level 1 Watershed Profile are consistent with the conditions observed in the study area:

A. The vast majority of the aquatic resources in the Great Valley have been significantly degraded through extensive conversion to agricultural, urban, and transportation land uses. As a result, aquatic features are generally in poor condition, though some features, including seasonal riverine and vernal pools and swales, are generally in excellent or good condition. The condition of features in the study area is generally tied to the type of feature: man-made or manipulated features are typically in poor or fair condition and natural features are generally in good or excellent condition. These conditions were anticipated by the Level 1 Watershed Profile and supported in the study area by the CRAM results. However, some vernal pools and swales near the Corcoran alternatives are in fair condition because they are near major stressors (State Route 43 and the existing BNSF Railway tracks).

B. The relative abundance and condition of aquatic resources in the study area reflect the relative condition of habitats within their watersheds. For example, aquatic resources within the study area identified through CRAM as being in relatively "poor" condition generally correspond to habitats in the greater watershed most impacted by altered hydrology and land conversion. Likewise, aquatic resources within the study area identified through CRAM as being in relatively "good" condition generally correspond to relatively natural habitats in the watershed.

C. As described in Section 6.1, Impacts on Aquatic Resources, and Section 6.2, Existing Conditions, most aquatic features in the study area are man-made or manipulated. Natural aquatic features are present in the study area, but their acreage and distribution are limited. The natural aquatic features present (vernal pools and swales and seasonal riverine features) are generally in better condition, but many of these features have been subject to disturbance associated with the conversation of adjacent areas and, in the case of seasonal riverine features, the reduction of the flood channel and riparian areas.

D. Similar aquatic features (canals/ditches, lacustrine, emergent wetlands, seasonal wetlands, seasonal riverine, riparian (not USACE jurisdictional), and vernal pools and swales) are present throughout the study area. Many of these aquatic resources have been manipulated or are man-made to support agricultural land use practices. However, as discussed in the Level 1 Watershed Profile, a relatively high density of vernal pool features is present in the Upper Deer–Upper White Watershed, which is associated with the Allensworth alternatives.

E. Due to the presence of extensive networks of canals and water diversions, clear watershed boundaries were not observed.

The above themes, which are discussed in detail in the Level 1 Watershed Profile and the Level 2 Impact Evaluation, reduce the potential for the project to result in a net negative impact on the project watersheds. The results of the watershed profile and project impact evaluation (both in terms of quantity and quality) indicate that compensatory mitigation will be conducted in select areas and will focus on select watersheds (consistent with project impacts to sensitive resources). Sufficient opportunities will be available to provide significant enhancements and benefits to one or more recipient watersheds that will, in both the short term and the long term, provide local and regional ecological benefit (or lift) to the watersheds and the condition of the associated aquatic features. At the conclusion of project implementation (i.e., after impacts and compensatory mitigation), the condition of the watersheds would be sustained or enhanced through the long-term preservation of aquatic resources and would experience no net loss of aquatic functions, values, or services (i.e., condition).

The project impacts to existing aquatic resources are organized by watershed and by project alternative so that the project proponents (i.e., Authority and FRA), along with USACE and EPA, can use this report to evaluate, identify, and compare the preferred project alternative and ultimately assist in the identification of the preliminary LEDPA.

# Section 1.0
## Introduction

# 1.0 Introduction

## 1.1 Purpose

A watershed-level analysis of aquatic resources for the Fresno to Bakersfield Section of the California High-Speed Train (HST) System has been developed in conformance with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) April 10, 2008 "Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (2008 Mitigation Rule) (33 Code of Federal Regulations [C.F.R.] Parts 325 and 332 and 40 C.F.R. Part 230) and California's Level 1-2-3 framework for wetland monitoring and assessment.

The Level 1-2-3 framework builds on information gathered at each of three levels (Level 1-2-3). Level 1 is the Watershed Profile, Level 2 is the Rapid Wetland Assessment/Impact Evaluation and Level 3 is the Intensive Site Assessment.

The Level 1 Watershed Profile is used to characterize land uses and the distribution and abundance of wetland types across an area. This level of assessment is used to determine the geographical priorities where more intensive wetland monitoring is to occur and to identify environmental indicators that can be monitored to approximate wetland conditions. The resulting data layers and landscape profiles provide valuable information to guide wetland protection and restoration decisions, including the location and design of compensatory mitigation projects.

The Level 2 Rapid Wetland Assessment/Impact Evaluation evaluates the general condition of individual wetlands using relatively simple indicators. These assessments are based on identifying stressors, such as road crossings, encroachments, and hydrologic alterations. Rapid wetland assessment methods are used to monitor and report on the condition of wetlands in a watershed and to identify sites where more intensive monitoring is needed. Results are also used in Clean Water Act (CWA) Section 401/404 permitting and other wetland decisions and can be used to evaluate the performance of compensatory wetland mitigation and other restoration projects.

The Level 3 Intensive Site Assessment is necessary to test the indicators used in rapid wetland assessments and to validate landscape level assessments. Intensive Site Assessment requires the identification of wetland reference conditions. This level of assessment is also used to determine the attainment of water quality standards at individual wetlands.

This Watershed Evaluation Report evaluates and provides the Level 1 and Level 2 evaluations and accomplishes the following tasks:

- Develops a data layer of land use types that represent disturbance categories.
- Inventories the aquatic resources within Hydrologic Unit Code 8 (HUC-8) watershed units (per land use type).
- Determines the type, amount, and relative condition of the aquatic resources in the watershed units and in the footprints of the HST alternatives in the Fresno to Bakersfield Section.
- Evaluates and assigns a relative existing condition to all aquatic resources in the Fresno to Bakersfield Section alternatives within the watersheds.
- Evaluates the relative post-project condition of the aquatic resources in the watersheds associated with the alternatives.
- Describes the approach to compensatory mitigation and provides a summary of potential compensatory mitigation properties.

- Considers the net change in the acreage and condition of the watersheds considering both post-project condition and compensatory mitigation.

The analysis methods, tools, and approach, such as the use of the California Rapid Assessment Method (CRAM), used to evaluate the functional condition of aquatic resources affected by the project and the post-project condition are provided in this Watershed Evaluation Report.

This Watershed Evaluation Report includes an overview of the process whereby the watershed-level analysis was conceived, planned, and implemented; this report also provides an analysis of currently available, watershed-level Geographic Information System (GIS) data to gather information about the types and relative conditions of the aquatic resources. The overall approach was discussed within an interagency group referred to as the Technical Working Group (TWG). The appendices to this report are as follows:

- Appendix A, Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM).
- Appendix B, Impact Evaluation Schematics.

## 1.2 Regulatory Context

This section discusses the regulatory context for the Watershed Evaluation Report within the existing Checkpoint C framework of the Environmental Impact Report / Environmental Impact Statement (EIR/EIS) process for the Fresno to Bakersfield Section of the HST System.

### 1.2.1 The MOU Process and Checkpoint C

The *NEPA/404/408 Memorandum of Understanding* (MOU) between the Federal Railroad Administration (FRA), California High-Speed Rail Authority (Authority), EPA, and USACE, dated November 2010 (FRA et al. 2010) and the Checkpoint C Preliminary LEDPA Determination require a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S." to assist in the analysis of impacts. The goal of the MOU is to facilitate compliance with the National Environmental Policy Act (42 United States Code [U.S.C.] Section 4321 *et seq.*), Section 404 of the Clean Water Act (33 U.S.C Section 1344), and Section 14 of the Rivers and Harbors Act (33 U.S.C. Section 408) process for the project-level (Tier 2) Environmental Impact Statement for the project. The integration process comprises three "checkpoints," which punctuate ongoing coordination efforts. These checkpoints are:

A. Definition of purpose and need for the Tier 2 HST project.

B. Identification of the Range of Alternatives to be studied in the project (Tier 2) EIR/EIS.

C. Preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) Determination; USACE Section 408 Draft Response; and Draft Mitigation Plan consistent with 33 C.F.R. Part 332 and 40 C.F.R. Part 230 (73 Federal Register [F.R.] 19,593, dated April 10, 2008).

This document provides information in support of the Checkpoint C Preliminary LEDPA Determination as it relates to the Section 404 of the Clean Water Act.

The CRAM is a tool for performing wetland condition assessments and meets the standards for "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S" required by the MOU. Using CRAM across all sections of the California HST System provides a uniform approach to assessing wetland health and watershed needs and is consistent with the 2008 Mitigation Rule. CRAM works by scoring metrics that are part of four key attributes: landscape and buffer, hydrology, physical structure, and biotic structure (CWMW 2012).

The *Condition Assessment Technical Work Plan* (Authority and FRA 2011a) details the technical approach to conducting the condition assessment for the Fresno to Bakersfield Section of the HST System. This Watershed Evaluation Report summarizes the overall approach, presents the outcome of the analysis, and draws conclusions about the effects of the project on the watersheds.

## 1.2.2 Technical Working Group

Several TWG meetings occurred to coordinate and communicate technical issues and clarifications regarding the application of the watershed approach. These technical issues included Level 1-2-3, assignment of condition values to aquatic features; identification of direct impacts, indirect impacts, and post-project conditions, and their application in determining the least environmentally damaging practicable alternative (LEDPA). Members of the TWG included the USACE, EPA, the State Water Resources Control Board, FRA, the Authority, and the Authority's regional consultants (for the Fresno to Bakersfield Section, the URS/HMM/Arup Joint Venture). The details of TWG meeting and the key discussion topics are summarized below.

The TWG meetings focused on discussion of the application of the 2008 Mitigation Rule, the Level 1-2-3 Framework, including development of Level 1 Watershed Profile and the Level 2 CRAM field assessment, impact assessment methodology (direct and indirect; permanent and temporary), methods to extrapolate CRAM scores into relative conditions for all aquatic features, and potential relative sensitivity to indirect impacts. The discussions and information that came out of them assisted in the development of this Watershed Evaluation Report, the Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report (Appendix A), mitigation planning and the development of the Compensatory Mitigation Plan, and the *Fresno to Bakersfield Section: Checkpoint C Summary Report* (Authority and FRA 2012e).

Two notable products were produced from the TWG meetings, one referring to the concept of developing watershed profiles for each particular watershed unit affected by the Fresno to Bakersfield Section and the other referring to the assessment framework for Checkpoint C and the Section 404(b)(1) determination process. These two products were integrated into the Checkpoint C Summary Report (Authority and FRA 2012e), this Watershed Evaluation Report, and the Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report (Authority and FRA 2012c; see also Appendix A).

### 1.2.2.1 Watershed Approach (August 2011)

The watershed approach relies on the use of a "watershed profiles" and project "impact profiles" (Sumner 2011). A component of the Section 404(b)(1) analysis is comparing the aquatic resource in the watershed profiles with the impact profiles for each HST alternative alignment to help make decisions as they concern compensatory mitigation and the net post-project condition of the watershed.

A watershed profile is a coarse estimation of the abundance and condition of types of aquatic resources in a project watershed area. A watershed profile is constructed by tabulating the relative abundance, diversity (of types), and condition of aquatic resources in project watershed areas. Project watershed areas are geographically bounded areas of watersheds that encompass the HST alternative alignments. California water planning watershed maps, U.S. Geological Survey (USGS) HUC-8 maps, and Level 4 Ecoregion maps can be used to demarcate project watershed area boundaries.

The abundance and type of aquatic resources within a project watershed area are gleaned from existing databases, such as the National Wetland Inventory, the National Hydrography Dataset (NHD), and the Holland Central Valley Vernal Pool Complexes dataset. The conditions of aquatic resources are suggested in a broad sense by overlaying the mapped occurrences of aquatic resources onto generally classified land use maps. This broad-scale analysis indicates general distribution of aquatic resources, the degree of interrelation among aquatic resources in the landscape, and the existence of landscape stressors and landscape buffers for aquatic areas.

An impact profile identifies both the amount (quantity) of aquatic resources affected (acreage and/or linear feet) and the condition of the aquatic resources (excellent, good, fair, or poor) extrapolated from the CRAM results. Each impact profile is then summarized by aquatic resource type and the type of impact (direct or indirect and permanent or temporary). The impact profile also includes an analysis of the post-project condition of the aquatic resources. Where applicable, this Watershed Evaluation Report summarizes these impacts and discusses them for each of the seven watersheds evaluated.

The precision (quality) of the estimates used in the impact profiles is sufficiently robust to make a relative comparison between the alternative alignments (e.g., an order of magnitude comparison; see Sumner 2011). Based on guidance received from the TWG meetings, the assessment approach used in this Watershed Evaluation Report, including CRAM sampling and extrapolation of survey results, meets this quality standard.

Combining the watershed profiles with the impact profiles helps determine the extent, if any, of substantial net impacts attributed to each of the alternative alignments. The criterion for making that determination is whether there is a risk that an alternative's impact profile will substantially degrade current-day watershed profiles. Special consideration is given to aquatic resource types in the watershed profile that are relatively rare, highly valued, or difficult to mitigate (e.g., restore, re-establish).

#### 1.2.2.2 Assessment Framework (September 2011)

An assessment framework was developed to summarize the types of analyses required by Checkpoint C. The components (or factors) of this framework include:

1. Aquatic resource acreage affected, classified by aquatic resource type and type of impact (direct and indirect), including non-wetland waters and wetlands.
2. Amount of impact on important/rare wetland acreage, which includes difficult-to-replace wetlands (e.g., vernal pools, seasonal riverine with riparian area).
3. Amount of impact on special-status habitats, including aquatic habitats, species listed under the federal Endangered Species Act (ESA), and ESA critical habitat.
4. Amount of impact on aquatic resources in good condition along the alignments, which is determined using both Level 1 and Level 2 (i.e., CRAM) data.
5. Relative risk of net project impact on the watershed.

In this context, net project impact means the extent to which impacts assessed at a smaller scale (an alignment) are likely to have a substantial effect on the functioning of the broader landscape. Each alternative is qualitatively evaluated relative to its risk of causing a net impact. The assessment of this factor is a qualitative comparison of the relative adverse effect of impacts along alternative alignments on the overall abundance, diversity, and condition of aquatic resources in the project watershed area(s). In other words, net impact is a comparison of the impact profile of each alignment (#1 through #4, above) with the broader "watershed profiles."

This watershed profile informs the impact review, and is useful in mitigation planning (i.e., using the "watershed approach" pursuant to the federal rule and the pending state rule). For example, if direct and net impacts cannot be adequately mitigated, then there is a risk of significant degradation.

In addition to the factors listed above, other assessment factors are also considered in making a LEDPA determination; these include nonaquatic habitat, cultural resources, community impacts, agriculture, etc.

Assessment factors required for making a permit determination based on the EPA Section 404(b)(1) Guidelines (alternative analysis and mitigation requirements) include:

1. Identification of the LEDPA.
2. Environmental restrictions (e.g., ensuring there are no violations of water quality standards, the ESA, and sanctuaries).
3. Significant degradation of waters of the U.S. (e.g., ensuring there is no significant degradation, which depends on the net impact, including mitigation).
4. Mitigation includes an examination of the relative amount of mitigation opportunity associated with each alternative and the potential for mitigation elements to enhance the overall area and/or quality of aquatic resources within each planning watershed and the project as a whole (as required by the 2008 Mitigation Rule). Addressing these requirements includes the completion of a mitigation plan for the selected LEDPA (taking into consideration watershed profiles and other site-specific information) and taking appropriate and practicable steps to minimize adverse impacts (i.e., applicants must take all appropriate and practicable steps to minimize adverse impacts on the aquatic environment).

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# Section 2.0
## Project Description

# 2.0 Project Description

The proposed action is to construct and operate an HST rail line from Fresno to Bakersfield (Figure 2-1). The Fresno to Bakersfield Section is one of nine sections that were identified in the Program EIR/EISs (Authority and FRA 2005, 2008, 2010). The nine HST sections constitute a system that would connect the major population centers of the San Francisco Bay Area with the Los Angeles metropolitan region. The California HST System is planned to be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley. Phase 2 would connect the Central Valley (Merced Station) to the state's capital, Sacramento, and another extension would connect Los Angeles to San Diego. The HST System is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology system that would employ the latest technology, safety, signaling, and automated train control systems. The trains would be capable of operating at speeds of up to 220 miles per hour over fully grade separated, dedicated tracks.

The Fresno to Bakersfield HST Section would be a critical link in the Phase 1 HST System connecting San Francisco and the Bay Area to Los Angeles and Anaheim. The Authority and the FRA's prior program EIR/EIS documents selected the BNSF Railway route as the preferred alternative for the Fresno to Bakersfield Section in the 2005 Statewide Program EIR/EIS decision document. Therefore, the project EIR/EIS for the Fresno to Bakersfield Section focuses on alternative alignments along the general BNSF Railway corridor.

The *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a) evaluates 10 alignment alternatives, including the No Project Alternative, the BNSF Alternative and the Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, Bakersfield South, and Bakersfield Hybrid alternatives (Figure 2-2). Of the nine Fresno to Bakersfield Section alternatives, eight alternatives deviate from the BNSF Alternative for portions of the route to avoid environmental, land use, or community impacts.

The infrastructure and systems for the Fresno to Bakersfield Section alternatives are composed of trains (rolling stock), tracks, grade-separated right-of-way, stations, train control, power systems, and maintenance facilities. The design of each alternative includes a double-track right-of-way to accommodate planned project operational needs for uninterrupted rail movement. Also, the HST System safety criteria preclude any at-grade intersections, and therefore the system must be grade separated from any other transportation system. This requirement means that planning the HST System would also require grade-separated overcrossings for roadways or roadway closures and modifications to existing systems that do not span the planned right-of-way.

The Fresno to Bakersfield Section would consist of a fully dedicated rail line, constructed from continuous welded steel rail. In the Fresno to Bakersfield Section, the alternatives would use four different track profiles. These track types have varying profiles: low, near-the-ground tracks are at-grade; higher tracks are elevated or on retained fill; and below-grade tracks are in a retained cut. Types of bridges that might be built include full channel spans, large box culverts, or, for some wider river crossings, limited piers within the ordinary high-water channel. Besides the alternative alignments, two station alternatives in Fresno, two potential station locations in the Hanford area, three station alternatives in Bakersfield, and five potential heavy-maintenance facility alternatives are considered.

The Fresno to Bakersfield Section would connect to Merced in the north and to Palmdale in the south. A heavy maintenance facility would be sited in either the Merced to Fresno Section or the Fresno to Bakersfield Section. Additional details on project features and construction are presented in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a).


**Figure 2-1**
Fresno to Bakersfield Section of the California HST System

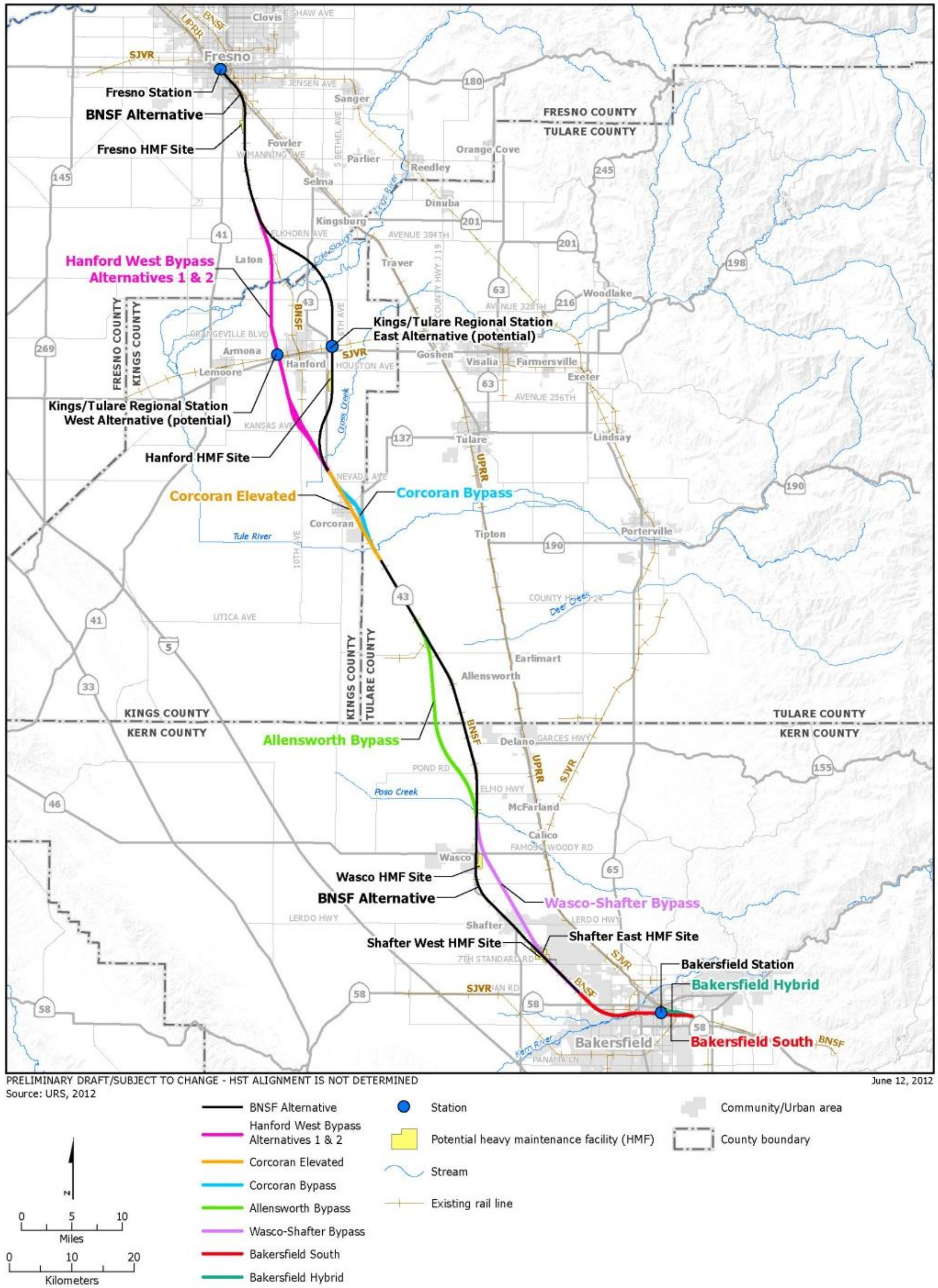


**Figure 2-2**
Fresno to Bakersfield Section alternatives

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# Section 3.0
## Methodology

# 3.0 Methodology

This section describes the methods used to develop the Level 1 and Level 2 analyses presented in this report. The analyses include developing a watershed profile, identifying the existing conditions of the aquatic resources, quantifying direct and indirect impacts on aquatic resources, and estimating the post-project condition of the aquatic resources. In some instances, the data used were developed in part at a national or statewide level by other sources (e.g., the U.S. Fish and Wildlife Service [USFWS], USGS). In other instances, the information used was collected and developed by the Authority's regional consultant, the URS/HMM/Arup Joint Venture. Information collected by the URS/HMM/Arup Joint Venture is described in more detail in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a), the *Fresno to Bakersfield Section: Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b), the *Fresno to Bakersfield Section: Preliminary Jurisdictional Waters and Wetland Delineation* (Authority and FRA 2011b), the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g), and the *Fresno to Bakersfield Section: Evaluation of Wetland Conditions Using the California Rapid Assessment Method* (CRAM) *Report* (Authority and FRA 2012c).

The Level 1 Watershed Profile uses a number of national and statewide or regional databases to estimate the types, distribution, extent (quantity), and condition of the aquatic resources in each watershed. This information helps identify the regional setting of the aquatic resource impacts expected to occur as part the implementation of the project. Direct and indirect impacts are conservatively estimated by overlaying the construction and project footprints on the results of the wetland delineation as presented in the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g).

The construction and project footprints were used to identify direct impacts. A 250-foot buffer around the footprints (i.e., the study area) was used to calculate indirect impacts to adjacent aquatic resources. The existing conditions of the aquatic resources were determined by a two-step process: (1) conducting a site-specific assessment using CRAM on a sample of aquatic features representative of the type of features found in the study area; and (2) extrapolating the CRAM results and assigning a relative condition (i.e., poor, fair, good, or excellent) to the aquatic features. The Level 2 Impact Evaluation consists of quantifying the impacts, assessing the condition of the aquatic resources, and extrapolating the conditions of the aquatic features.

The model for estimating the post-project conditions of the aquatic resources directly affected by implementation of the project was developed based on a set of projections that extrapolated post-project condition based on the type of aquatic resource affected, the location within the construction or project footprints, the type of impact (direct or indirect), and the existing relative condition. A similar set of projections was generated to assess the risk (low, moderate, or high) of loss or change to aquatic resources as a result of indirect impacts.

The methods, as employed and described herein, were largely developed in close coordination with the USACE and EPA as part of the TWG meetings.

## 3.1 Methodology: Watershed Evaluation

A Level 1 Watershed Profile was developed to provide an analysis and description of the seven HUC-8 watersheds that intersect the Fresno to Bakersfield Section alternative alignments. For each watershed, the profile includes a description of the major aquatic features and associated land uses. In the analysis, land use is a proxy to distinguish higher-quality aquatic features from features that are likely degraded. Aquatic features in high-intensity land use types were considered to be degraded based simply on surrounding land uses. Conversely, aquatic features in low-intensity and natural land use types are considered less disturbed. The land uses for each watershed were identified using a number of existing datasets that have been developed by State of California regulatory agencies, including:

- California Essential Habitat Connectivity Project Natural Landscape Blocks (Spencer et al. 2010) map and classify areas of natural land. The California Department of Fish and Game and the California Department of Transportation commissioned the California Essential Habitat Connectivity Project to assist in land use planning, transportation planning, land management, and conservation planning. This dataset provides an assessment of natural lands and assists users in avoiding, minimizing, and mitigating impacts to habitat connectivity during the transportation-planning process. The Essential Habitat Connectivity Project identifies natural landscape blocks through a number of approaches, including the use of the Ecological Condition Index developed for the California Legacy Project (Davis et al. 2003, 2006); the Essential Habitat Connectivity Project also considers conservation protection status and areas known to have high biological value.
- California GAP Analysis Land-Cover for California (UCSB 2002) maps land cover and natural communities. The California GAP Analysis Land-Cover for California is a product of a number of vegetation mapping systems that are best described provisionally as the National Vegetation Classification Standards (more recently known as the "UNESCO/TNC system"). This dataset also incorporates aspects of the California Natural Diversity Database vegetation descriptions for natural land use types and USGS methods for identifying non-vegetation and human-induced land use categories (e.g., urban, barren, agricultural land uses) (Anderson et al. 1976).

The various land uses were categorized by land use intensity into the following categories: relatively undisturbed (natural), low-intensity agriculture, and high-intensity agriculture/developed land.

Aquatic features within each watershed were mapped using a number of available databases that are widely accepted and used for understanding the locations and types of aquatic resources within a given region. These databases were produced or funded by the following natural resource regulatory agencies:

- The National Wetlands Inventory (USFWS 2011b), which identifies the approximate locations and types of wetlands in each watershed. This dataset was used to calculate acreage and map locations of the following wetland types within each watershed:
  - Emergent wetland: herbaceous marsh, fen, swale, or wet meadow.
  - Forested/shrub wetland: forested swamp or wetland shrub bog or wetland.
  - Freshwater pond: pond.
  - Lake: lake or reservoir basin.
  - Other wetland: farmed wetland, saline seep, or other miscellaneous wetland.
  - Riverine: river or stream channel.
- The National Hydrography Dataset (USGS and EPA 1999), which identifies the approximate locations and types of rivers, streams, canals, and ditches in each watershed. In maps and tables, this dataset is divided into natural features (streams/rivers) and man-made or altered features (canals/ditches). Results from this dataset were used to calculate linear feet of these feature types.
- The Holland Central Valley Vernal Pool Complexes data layer (Holland 2009b), which identifies vernal pool landscapes (not vernal pool areas). These data are presented as acres of vernal pool communities, which include both upland and aquatic habitats. The acreage associated with the data is often significantly greater than the actual area of aquatic features present within a given area.

A combination of the land use and the aquatic feature databases was used to provide a profile for each of the watersheds that intersect the Fresno to Bakersfield alternative alignments. The Level 1 Watershed Profile lists (1) the types of aquatic features; (2) the extent or amount of each aquatic feature within a watershed; and (3) the relative condition of the aquatic features within each of the watersheds. Because of the significant variation in topography, soil, vegetation, and land uses in the watersheds crossed by the alternative alignments, the types, extent, and conditions vary greatly. To provide a meaningful analysis of the watershed profile as it relates to the context of the alternative alignments, the watershed profile was divided into ecological sections based on the USDA's ecological subregions (USDA 2007).

Both the types and the extent of the aquatic features present in each watershed were generated directly from the aquatic feature databases. The extents of some aquatic features are represented as polygons, which translate into areas (acreages), and other features, typically those that are linear, are represented as line features, which translate into linear feet. In a few instances, aquatic features from one database overlap with features from another database. In these cases, feature types were selectively removed from all but one of the databases based on a detailed review. This process made possible the development of a more robust dataset.

The assessment of the condition of an aquatic feature in a watershed is based on the location of the aquatic feature within a given land use type. The ecological condition of the aquatic feature is categorized as either poor, fair, or good based on the land use type and land use intensity in the area surrounding the aquatic feature. A water feature in relatively undisturbed (natural) land is given a condition of *good*. A feature in a low-intensity agriculture area is considered fair, and a feature in a high-intensity agriculture/developed land area is considered to have a condition of *poor*. The land use types are as follows:

- Aquatic features in high-intensity land use cover types (e.g., orchard and vineyard, croplands, urban,) are subject to a number of significant man-induced alterations, inputs, and constraints and are typically in poor ecological condition. High-intensity land uses:
  - Provide limited or no buffers to aquatic resources.
  - Often control or significantly alter the natural hydrology.
  - Have limited wildlife and biological value.
  - Often remove the physical structure of aquatic features and often include man-made features.
- Aquatic features in low-intensity land use cover types (e.g., barren) are subject to few man-induced alterations, inputs, and constraints and are typically in fair ecological condition. Low-intensity land uses:
  - Provide some buffers to aquatic resources.
  - May mildly to significantly alter the natural hydrology.
  - Have some wildlife and biological value.
  - Often retain the natural physical structure of aquatic features, though some characteristics may be removed or altered.
- Aquatic features in natural land use cover types (e.g., annual grassland, alkali desert scrub, blue oak woodland) are generally subject to minor man-induced alterations, inputs, and constraints and are typically in good ecological condition. Natural land uses:
  - Provide important buffers to aquatic resources.
  - Typically have natural or near-natural hydrology, though upstream or downstream land uses may affect aquatic features.

- Have considerable wildlife and biological value.
- Retain natural physical structure, though historical land use practices have reduced or altered some of the natural characteristics.

In general, these databases may over- or underestimate the extent of natural aquatic features in urban or agricultural regions; these regions are subject to constant manipulation, and even though the data presented are relatively current, the data may not reflect present-day conditions. Maps showing the aquatic features and land use types were generated for each watershed from the information in these databases. Charts were also created; the charts describe the quality and distribution of the aquatic features in each watershed by ecological section. Each chart uses linear feet to show the distribution of the rivers, streams, canals, and ditches and acres to show lakes, ponds, and wetlands. In addition, for each watershed, a table presents the breakdown of each type of aquatic feature, its presumed quality, and its size by ecological section.

## 3.2 Methodology: Existing Conditions

This section describes the methods used to identify the existing conditions of the aquatic resources in the study area. The condition of aquatic resources is one of the components analyzed as part of the Section 404(b)(1) alternatives analysis and is required as set forth in the MOU (the requirement to conduct a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S.") (EPA et al. 2010). The existing conditions can be used to establish the baseline from which project impacts are analyzed and assist in the identification of compensatory mitigation requirements.

The condition of the aquatic resources in the study area was established using a two-step process: (1) the CRAM assessment and (2) extrapolation of the CRAM assessment results to provide relative condition values. In the first step, the conditions of a representative sample of aquatic features were assessed using CRAM. CRAM works by scoring metrics that are part of four key attributes: landscape and buffer, hydrology, physical structure, and biotic structure. To the extent possible, CRAM methodology, as described in the CRAM User's Manual, Version 5.0.2 (CWMW 2008), Version 6.0 (CWMW 2012), and corresponding module field books, was followed. A complete description of the field methodology is provided in the CRAM report (Appendix A). In the CRAM approach, aquatic resources are scored from 25 (poor) to 100 (ideal).

In areas where permission to enter had been granted, CRAM was conducted on the various types of aquatic resources present in the study area. In areas where permission to enter had not been granted, it was not possible to obtain field-assessed CRAM condition scores for all aquatic features present in the study area. Rather, the CRAM assessment attempted to assess a representative sample of aquatic feature types within the confines of areas where permission to enter had been granted. Where permission to enter was allowed, the CRAM assessment made use at least five sample assessment areas for each type of aquatic resource (canal, ditch, vernal pool, and seasonal riverine).

A CRAM-certified trainer, Chad Roberts, Ph.D. (CRAM coordinator), of Roberts Environmental and Conservation Planning, provided oversight and guidance, and both the CRAM coordinator and URS/HMM/Arup Joint Venture staff conducted the CRAM field work. Field staff used best professional judgment, as informed by direction from the CRAM coordinator and consultation with the USACE and EPA, in using CRAM.

In the second step, the results from the CRAM assessment were extrapolated to provide relative condition values for all aquatic resources in the study area. The extrapolation process started by converting the CRAM scores to the qualitative condition values of poor, fair, good, or excellent (Table 3-1). The range of CRAM scores identified in the field for each sampled aquatic resource type was calculated and converted to a relative condition indication (poor, fair, good, or excellent) for those resource types.

**Table 3-1**
CRAM Scores as They Relate to Relative Condition

| CRAM Score Range | Relative Condition | Types of Aquatic Features |
|---|---|---|
| 81–100 | Excellent | —[1] |
| 62–80 | Good | Seasonal riverine, vernal pool |
| 44–61 | Fair | Ditch, seasonal wetland |
| 25–43 | Poor | Canal, retention/detention basin |

[1] Individual vernal pool and vernal pool system CRAM scores fell into the excellent relative condition category. However, the average vernal pool score corresponded to a good relative condition.
CRAM = California Rapid Assessment Method

The relative condition for all aquatic features of a particular type was combined with other existing information (e.g., land use and wildlife habitat mapping) and used to inform and extrapolate conditions for all aquatic features. The extrapolation of conditions is important to qualify the conditions for aquatic resources where permission to enter was not granted. For example, the range of CRAM scores of retention/detention basins was between 31.6 and 51.5 (poor to fair) and similar features (other retention/detention basins) found in a similar landscape context (agriculture) were assigned the same relative condition (poor or fair). The range of the CRAM scores for the feature type, along with aerial photographic interpretation and other factors, including feature type, watershed, and proximity to stressors, were also considered in extrapolating condition scores. Although such extrapolations are inherently limited, they provide meaningful information and assistance in understanding the abundance and relative condition of aquatic resources that may be affected by the project.

## 3.3 Methodology: Impact Calculations

This section describes the methods used to evaluate impacts on aquatic features, special aquatic features, and terrestrial habitats. Four types of impacts are analyzed: direct-permanent, direct-temporary, indirect-bisected, and indirect. Direct impacts were calculated for all aquatic features present in both the construction and the project footprints. Indirect impacts were calculated for all aquatic features present within the 250-feet study area surrounding the construction and project footprints.

The extents (quantity: area) of the aquatic features affected by the project were calculated using a GIS model in which the mapped aquatic features as presented in the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g) were overlaid on the construction and project footprints. The footprints include all the infrastructure and construction areas that would be needed to build and operate the Fresno and Bakersfield Section of the HST System. In general, temporary impacts are those associated with construction activities (laydown and storage areas) and utility relocations in the construction footprint; permanent impacts are associated with permanent infrastructure, including the right-of-way for the HST tracks, the stations, the road overcrossings, the electrical facilities, and the heavy maintenance facility site alternatives.

The output of the GIS model included calculations of the acres of aquatic features directly and indirectly affected by the project. Schematic drawings that represent the types of footprint features and the four types of impacts (direct-permanent, direct-temporary, indirect-bisected, and indirect) are provided in Appendix B. These types of impacts are described in more detail below.

#### 3.3.1.1 Direct Impacts

Direct impacts are impacts to all aquatic features or portions of aquatic features within the construction and project footprints. Direct impacts result from filling existing aquatic features or excavating soils of aquatic features, thereby removing all or a portion of those features. For aquatic features that are partially present in the construction or project footprint, only the portion within the footprint is considered directly affected. Direct impacts are classified into either permanent or temporary impacts.

Permanent and temporary impacts are largely distinguished by the purpose of the disturbance and whether the impact occurs solely for the construction phase or would result in a permanent or long-term disturbance of the resource. For example, temporary impacts are associated with construction staging areas and underground utility relocation efforts, whereas permanent impacts result from the construction of the HST tracks, stations, and associated infrastructure (e.g., road overcrossings, electrical facilities). For vernal pool and swale features that straddle the footprint, the portion of the feature within the footprint would be considered to be directly affected. The portion of the feature outside the construction footprint would be said to undergo an "indirect-bisected" impact.

**Direct-Permanent Impacts**

Direct-permanent impacts occur to all aquatic features present within the project footprint of permanent construction elements. Permanent project footprint elements include:

- BNSF yard relocation.
- Canal relocation.
- Drainage basins.
- Freight rail relocation.
- Heavy maintenance facility sites.
- Train track (at-grade, elevated, and below-grade).
- Pedestrian bridges.
- Road closures.
- Roadways (including underpasses).
- Train stations.
- Traction power sub-stations.

Most of these construction elements would result in the permanent filling of aquatic features in the project footprint associated each element. However, elevated train track, which includes bridges, would be an exception because these structures would only require fill within a limited portion of the footprint, where supports and pilings are located. Outside of the limited area of fill, aquatic features spanned by elevated track or bridges would potentially be degraded but would not be permanently filled. However, to provide a conservative estimate of aquatic resource impacts, the portion of the footprint beneath the viaduct or elevated track structure is considered to be permanently impacted.

**Direct-Temporary Impacts**

Direct-temporary impacts can occur to aquatic features present within the footprint of temporary construction elements. Temporary construction footprint elements include:

- Construction staging areas.
- Natural gas line relocation.
- Petroleum line relocation.
- Removal of base and surfacing.
- Removal of bridge.
- Temporary construction easement.
- Transmission line relocation.
- Utility easement.

The duration of the direct-temporary construction elements varies from months to years. The disturbances associated with utility relocations are anticipated to be relatively short in duration, but the disturbances associated with construction staging areas may be longer in duration (e.g., 5 years). Aquatic resources subjected to direct-temporary impacts will be restored to their pre-project condition after the completion of construction.

#### 3.3.1.2 Indirect Impacts

Indirect impacts to aquatic features would occur within 250 feet of the construction and project footprints. Indirect impacts would not overlap with direct impacts. Indirect impacts would occur due to the alterations in hydrology and soil that result from adjacent direct impacts associated with construction and project activities. Adjacent direct impacts may indirectly result in changes in the hydrology of an aquatic feature by reducing, increasing, or diverting the flow of its water source. Indirect impacts are not subject to dredging or discharge of fill material and are not subject to construction or project encroachment. For calculating the acres of indirect impacts to aquatic features, two possible impact levels were applied to the GIS model: indirect-bisected and indirect.

**Indirect-Bisected Impacts**

This impact type only occurs to vernal pools and vernal swales and reflects their sensitivity to disturbance. These vernal features are particularly sensitive to soil disturbance. In instances where a vernal feature straddles the construction or project footprints, direct impacts to the feature may result in significant disturbance to the feature. The indirect-bisected category was developed to track these potentially significant indirect impacts. Other aquatic resources present in the 250-foot area beyond the construction footprint (man-made features and seasonal riverine features) are not as sensitive to indirect impacts and therefore are not calculated in this manner.

Therefore, for vernal features that cross into the construction or project footprint, only the portion of the vernal pool outside the footprint is considered to be subject to indirect-bisected impacts. Any portion of the vernal feature that occurs inside the footprint is defined as a direct impact. Impacts to vernal features located entirely within the study area but outside the footprint are identified and quantified as an indirect impact.

**Indirect Impacts**

Indirect impacts to aquatic features are quantified based on the extent and type of aquatic feature present within 250 feet of the construction and project footprints. For features that extend into the construction and project footprints, only the portion of the feature outside of the footprint is categorized as being subject to an indirect impact. The portion of the aquatic feature inside the construction and project footprints is categorized as a direct impact (either direct-permanent or direct-temporary). However, for vernal pools, vernal swales, and vernal pool and swale complexes, if the vernal feature extends into the construction and project footprints, the indirect impact is categorized as an indirect-bisected impact (see above). Indirect impacts to vernal pools are quantified as—and only include—those vernal features that are entirely outside of the construction and project footprints.

## 3.4 Methodology: Post-Project Conditions

The post-project conditions of aquatic resources in and adjacent to the construction and project footprints were estimated using a set of projections generated for the project. These projections considered the type of aquatic feature (man-made or natural), the type of impact (direct or indirect), and the relative condition (poor, fair, good, or excellent). The post-project condition assessment is important to identify the net aquatic functions and services lost within each watershed or by each project alternative, so that decisions can be made in terms of understanding the mitigation obligation to achieve "no net loss" of aquatic functions and services (or conditions).

The results of the relative condition assessment (described above) indicate that a set of projections was generated for direct impacts and for indirect impacts. After the application of the projections, wetland scientists reviewed the results and used best professional judgment to make minor modifications on a feature-by-feature basis. Modifications to impacts and post-project condition were made to features separated from the construction and project footprints by the existing BNSF railroad tracks. The BNSF railroad provides a buffer to those aquatic features to the east from the effects of the HST project because the footprint of the HST project is west of the existing BNSF railroad tracks. Therefore, the indirect impacts were modified to "low" for such features as seasonal wetlands and vernal pools and swales, that otherwise would have been considered moderately affected by the project.

#### 3.4.1.1 Direct Impacts

For post-project conditions resulting from direct impacts, the projections were largely based on the construction or project element. The post-project condition assessment includes the implementation of the proposed mitigation measures identified in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* that would restore direct-temporary impacts and some direct-permanent impacts. Under direct impacts, three post-project condition outcomes where identified: (1) the feature is no longer present; (2) the feature has a reduced condition from its existing condition; or (3) the feature does not change from its existing pre-construction condition. A summary of the projections used to generate the post-project conditions associated with direct impacts on aquatic resources is provided in Table 3-2.

**Table 3-2**
Summary of Post-Project Condition of Aquatic Resources: Direct Impacts

| Construction Element | Type of Direct Impact | Man-Made Aquatic Resources [a] | Natural Aquatic Resources [b] |
|---|---|---|---|
| BNSF yard relocation | Permanent | Does not exist | Does not exist |
| Canal relocation | Permanent | Does not exist | Does not exist |
| Construction area | Temporary | No change | Reduced condition |
| Drainage basin | Permanent | Does not exist | Does not exist |
| Freight rail relocation | Permanent | Does not exist | Does not exist |

**Table 3-2**
Summary of Post-Project Condition of Aquatic Resources: Direct Impacts

| Construction Element | Type of Direct Impact | Man-Made Aquatic Resources [a] | Natural Aquatic Resources [b] |
|---|---|---|---|
| Heavy maintenance facility | Permanent | Does not exist | Does not exist |
| HST track | | | |
| *At-grade* | Permanent | Does not exist | Does not exist |
| *Elevated* | Permanent | No change | Reduced condition |
| *Below-grade* | Permanent | Does not exist | Does not exist |
| Pedestrian bridge | Permanent | Does not exist | Does not exist |
| Roadway work (closures, overpasses, and underpasses) | Permanent | Does not exist | Does not exist |
| Stations | Permanent | Does not exist | Does not exist |
| Traction power sub-station | Permanent | Does not exist | Does not exist |
| Utility line relocation (natural gas, petroleum, and transmission line relocation) | Temporary | No change | Reduced Condition |

[a] Man-made aquatic resources include canals, ditches, emergent wetlands, reservoirs, and retention/detention basins.
[b] Natural aquatic resources include seasonal riverine features, seasonal wetlands, vernal pools, and vernal swales.

## Direct-Permanent Impacts

For most direct-permanent impacts, the post-project condition of aquatic resources is that the feature is no longer present. Aquatic features will not long be present when HST tracks are constructed at-grade and where impacts are associated with other HST facilities and infrastructure. However, aquatic features in areas where the HST track would be constructed on an elevated structure may retain some of their existing functions and services (or conditions). For example, seasonal riverine, canals, or ditches below an elevated structure would likely retain some of their existing functions and services (conditions). However, for sensitive features such as vernal pools, the post-project condition would be that the feature is completely lost (no longer present).

## Direct-Temporary Impacts

For all direct-temporary impacts, the post-project condition results in either no net change in feature condition or reduced relative condition, depending on the type of aquatic feature. Man-made features (canals, ditches, retention/detention basins, emergent wetland, and reservoirs) that are already highly manipulated and generally have low existing condition values can and will be restored to their pre-project condition after the completion of temporary construction activities and the implementation of project restoration measures. Therefore, direct-temporary impacts will result in no change in these features. Seasonal riverine, riparian areas, and seasonal wetland features are more sensitive to disturbance and are difficult to replace due to alterations in hydrology, soil, and/or vegetation that would occur as a result of the project. Such alterations are expected to reduce the condition of these features from their existing condition. Because it is difficult to restore vernal pools to pre-project conditions after they are temporarily affected, all impacts on vernal pools are considered permanent and would therefore cause those vernal pools to no longer exist.

#### 3.4.1.2 Indirect Impacts

Although no direct impacts would occur in—or fill material would be placed in—aquatic resources that occur outside of construction and project footprints (area of direct impacts), aquatic features in the 250-foot buffer could be indirectly affected due to the proximity of these resources to the direct impacts and the effects that direct impacts would have on the surrounding landscape, hydrology, and physical and biological conditions. For calculating the post-project conditions of aquatic features that are indirectly affected, three possible indirect impact levels (risk) were applied to the GIS model: high, moderate, and low. Post-project conditions were calculated based on the risk of indirect impacts and type of aquatic resource. A summary of the projections used to identify the risk of adverse indirect impacts on aquatic resources is provided in Table 3-3.

**Table 3-3**
Summary of Risk Assessment for Aquatic Resources: Indirect Impacts

| Type of Aquatic Resource | Man-Made or Natural | Type of Indirect Impact | Risk of Indirect Impacts | Post-Project Condition | Notes |
|---|---|---|---|---|---|
| Canals/ditches | Man-made | Indirect | Low | Same as existing condition | Highly manipulated |
| Emergent wetland | Man-made | Indirect | Low | Same as existing condition | Most features highly manipulated. |
| Lacustrine | Man-made | Indirect | Low | Same as existing condition | Highly manipulated |
| Riparian (not USACE jurisdictional) | Natural | Indirect | Moderate | Same as existing condition / reduced by one condition class | Features tied directly to seasonal riverine impacts. Post-project condition is the same as existing condition for features that have a poor existing condition. |
| Seasonal riverine | Natural | Indirect | Moderate | Same as existing condition / reduced by one condition class | Post-project condition is the same as existing condition for features that have a poor existing condition. |
| Seasonal wetland | Natural | Indirect | Low/moderate | Same as existing condition / reduced by one condition class | Some features Low risk. Post-project condition is the same as existing condition for features that have a poor existing condition. |
| Vernal pools and vernal swales | Natural | Indirect | Low | Reduced by one condition class | Applies to vernal pools east of BNSF |
| | Natural | Indirect | Moderate | Same as existing condition / reduced by one condition class | Post-project condition is the same as existing condition for features that have a poor existing condition. |
| | Natural | Indirect-bisected | High | Reduced to poor condition | Abutting direct impact |

Because the functions and services (conditions) of man-made aquatic features are already low due to a number of existing stressors, additional HST-induced impacts are not expected to result in any significant overall change in the quality of these features. Therefore, canals/ditches, emergent wetland, and lacustrine features are subject to low indirect impacts. These resources have a low risk of being converted to another wetland type or being reduced in functions and services (or conditions). Their post-project condition is expected to remain the same as their existing condition. Because the majority of man-made aquatic features have a poor existing condition, their post-project condition resulting from low risk indirect impacts will also be poor. For man-made or manipulated features with fair or good existing conditions (as applies to emergent wetland), their post-project condition will remain fair or good because the risk to change is low.

Because seasonal riverine, riparian, and seasonal wetlands are more sensitive to indirect alterations to hydrology and landscape, indirect impacts to these aquatic feature types are generally projected to be moderate. The resulting post-project condition for these features is expected to be reduced by one condition class, unless the existing condition is poor, in which case, the condition does not change. For example, most seasonal riverine features have an existing condition of good, so moderate indirect impacts to these features would result in a post-project condition of fair. For seasonal wetlands east of the existing BNSF railroad tracks, the risk of indirect impacts is expected to be low, due to the buffer the tracks provide from construction and project impacts. The post-project condition of these features would remain the same as their existing condition, which is generally fair.

Because of the ecological sensitivity of organisms and processes in vernal pools and vernal swales, the risks associated with adverse indirect impacts are projected to be high or moderate. The difference between moderate and high risk indirect impacts is based on the proximity and location of the impact in relation to direct impacts. For vernal features that are bisected by the project footprint (with indirect-bisected impacts) and abut direct impacts, the risk of being converted to another aquatic resource type (seasonal wetland or not present) is high. The resulting post-project condition of these features, regardless of existing condition, is assumed to be poor. Vernal pool features that are entirely outside of the construction and project footprints on an at-grade profile are at moderate risk. The post-project condition of these vernal pool features would be reduced by one condition class. For vernal pools with an existing condition of good, the moderate risk associated with indirect impacts would result in a post-project condition of fair. For vernal pool features on the east side of the existing BNSF railroad tracks and outside the construction and project footprints, the risk of indirect impacts is low. Therefore, the post-project condition of these vernal pool features would remain the same as their existing condition, which is either good or fair.

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# Section 4.0
## Environmental Setting

# 4.0 Environmental Setting

This section discusses the physical and biological conditions identified during pre-field investigations, reconnaissance-level surveys, and field surveys in the study area.

The Fresno to Bakersfield Section of the HST System is in in the San Joaquin Valley of California. In general, it parallels the existing BNSF Railway tracks and State Route (SR) 43. The study area is west of SR 99 and east of Interstate 5. The alignment trends in an overall northwest to southeast direction for approximately 118 miles with a minimum study area width of 250 feet. The study area crosses a number of major rivers, canals, agricultural ditches, smaller creeks, and ephemeral drainages and is primarily composed of agricultural lands, urban and rural communities, and scattered fragments of undeveloped natural habitat. The following sections provide a general overview of the physical conditions (e.g., geological setting, climate, watershed, hydrology, soils) and biological conditions (e.g., terrestrial habitats and land uses, aquatic resources and special areas, conservation areas).

## 4.1 Physical Conditions

The existing physical conditions pertinent to the Watershed Evaluation Report include physiography and regional geologic setting, climate, watershed, hydrology, and soils. Five ecological sections are represented in the Tulare Lake Basin, as shown on Figure 4-1. They are the Sierra Nevada Ecological Section, the Sierra Nevada Foothills Ecological Section, the Great Valley Ecological Section, the Central California Coast Ranges Ecological Section, and the Southern California Mountain and Valley Ecological Section. The Fresno to Bakersfield Section alternative alignments lay entirely within the Great Valley Ecological Section; the alternatives are bordered by the Sierra Nevada and Sierra Nevada Foothills ecological sections to the east, the Central California Coastal Ranges (Coast Ranges) Ecological Section to the west, and the Southern California Mountain and Valley (Mountain and Valley) Ecological Section to the south.

### 4.1.1 Physiography and Regional Geologic Setting

The project is in the Central Valley of California, which is in the Great Valley Geomorphic and Physiographic Province (CGS 2002). The Central Valley is a large, nearly flat valley bound by the Klamath and Trinity mountains to the north, the southern Cascade Range and the Sierra Nevada to the east, the San Emigdio and Tehachapi mountains to the south, and the Coast Ranges and San Francisco Bay to the west. The Central Valley consists of the Sacramento Valley in the north and the San Joaquin Valley in the south.

The Central Valley occupies a structural trough created about 65 million years ago by the collision of the Pacific and North American tectonic plates. Sediment from ocean water, river deposition, and glacial deposition filled the trough with an approximately 6-mile-thick layer of continental and marine sediments above rock (Authority and FRA 2004).

The study area is in the central part of the San Joaquin Valley. The topography in this part of the Central Valley is flat-lying, with elevations across the project alternatives and the HMF site alternatives ranging from +395 feet (North American Vertical Datum of 1988) to +205 feet (North American Vertical Datum of 1988). A general downward gradient occurs in the study area to the west-southwest, determined principally by the gentle slope of the vast alluvial fans extending from the Sierra Nevada in the east to the center of the San Joaquin Valley.

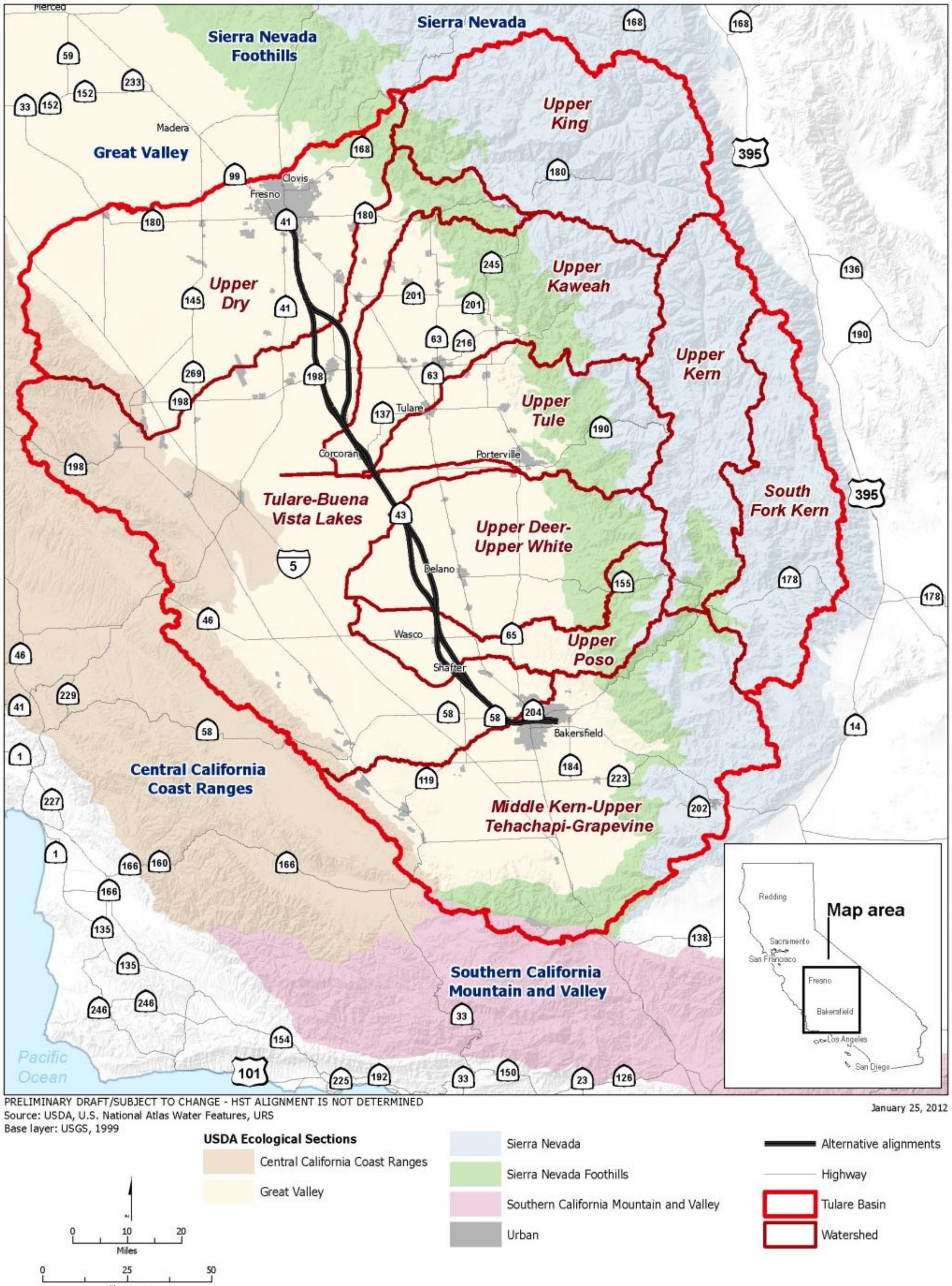



**Figure 4-1**
Tulare Lake Basin ecological sections and watersheds

### 4.1.2 Climate

The climate within the study region is semi-arid, with long, hot, dry summers and relatively mild winters. Heavy rainfall and snow in the western Sierra Nevada are the major sources of water in the Tulare Lake Basin (Gronberg et al. 1998). As determined from the long-term records of precipitation, the average annual precipitation in the study region ranges from approximately 6.23 to 10.94 inches. More than 80% of the precipitation in the study area occurs from November through April. In the Sierra Nevada, the majority of the mean annual precipitation falls as snow and ranges from 20 inches in the foothills to over 80 inches at higher elevations. The annual precipitation in the Coast Ranges, west of the valley floor, ranges from 10 to more than 20 inches (Gronberg et al. 1998).

### 4.1.3 Watershed

The Fresno to Bakersfield Section of the HST system lies in the southern portion of California's San Joaquin Valley, within the Tulare Lake Basin (Figure 4-1). The Tulare Lake Basin is approximately 16,400 square miles and mostly spans Fresno, Kings, Tulare, and Kern counties (CVRWQCB 2004). The Tulare Lake Basin is drained by the Kings, Kaweah, Tule, and Kern rivers, which flow to the dry beds of Tulare, Buena Vista, and Kern lakes. The Fresno to Bakersfield Section occurs within seven HUC-8 watersheds in the Tulare Lake Basin (Figure 4-2):

- Upper Dry Watershed (18030009)
- Tulare–Buena Vista Lakes Watershed (18030012)
- Upper Kaweah Watershed (18030007)
- Upper Tule Watershed (18030006)
- Upper Deer–Upper White Watershed (18030005)
- Upper Poso Watershed (1803004)
- Middle Kern–Upper Tehachapi–Grapevine Watershed (1803003)

Before agricultural development, the Tulare Lake Basin was dominated by four large, shallow, and mainly temporary inland lakes (Gronberg et al. 1998). The Tulare Lake bed, which was the most northerly lake of the four, has been turned into a system of approximately 103 miles of levees and irrigation canals to direct flooding away from farmed tracts of land (USACE 1996). The Kern River once flowed south and west across the southern portion of the valley through a complex system of sloughs, creeks, ponds, and permanent wetlands and fed Buena Vista and Kern lakes.

To convey water for agricultural purposes, many watercourses are highly altered from their natural state. Farmers and other agricultural producers pump groundwater and surface water to and from the numerous canals and drains that deliver irrigation water to and from agricultural fields. Composed of packed earth or concrete lining, the canals generally lack the meanders, vegetation, biota, and other features of natural streams.

The California Aqueduct and Friant-Kern Canal are major water conveyance systems that cross the study region. The California Aqueduct, which is approximately 30 miles west of the alternative alignments, was constructed in the 1970s and supplies agricultural and municipal areas in Southern California. The California Aqueduct generally runs north to south.

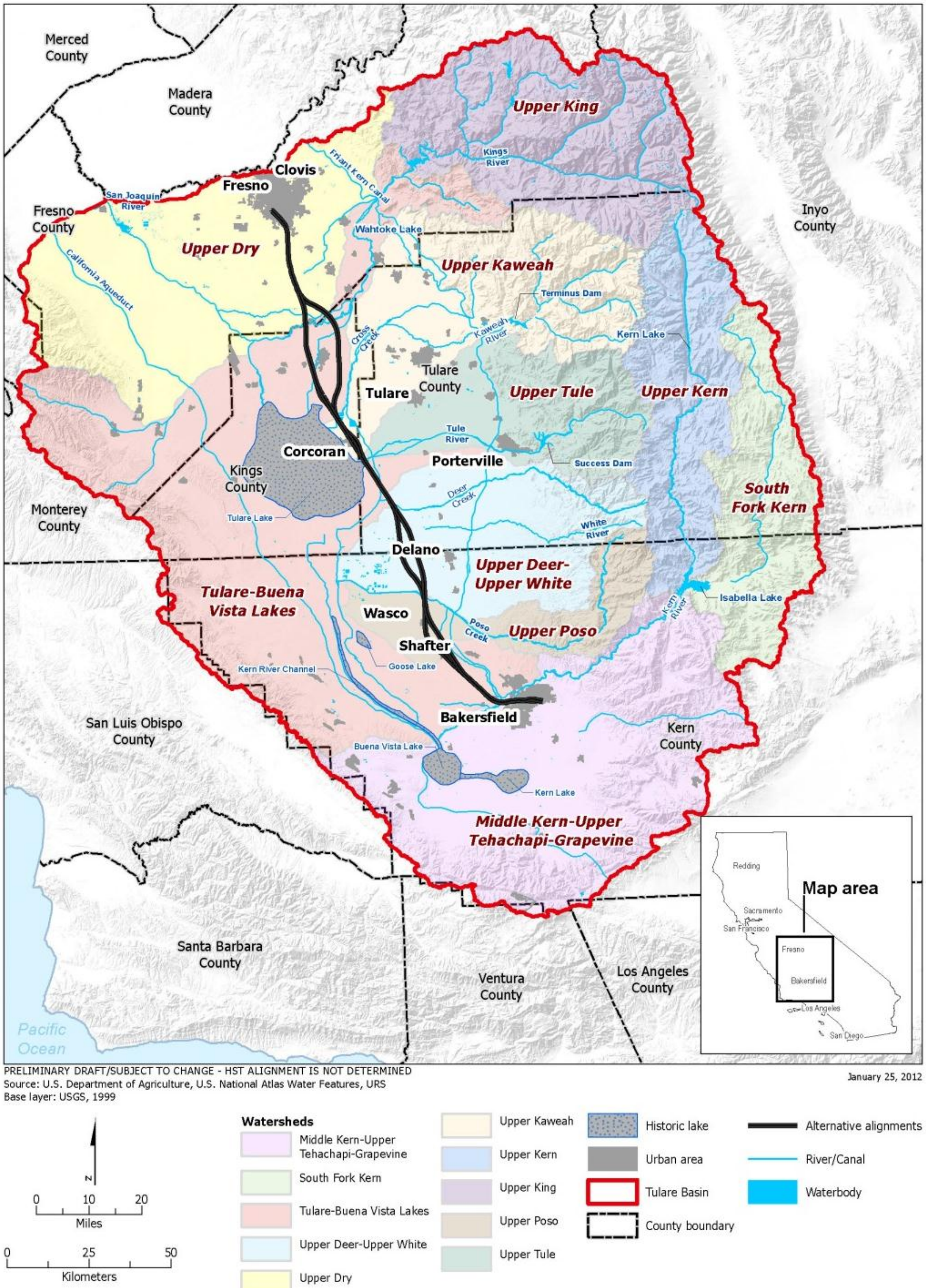



**Figure 4-2**
Tulare Lake Basin watersheds

The Friant-Kern Canal transports water south from Millerton Lake, a reservoir north of Fresno created by Friant Dam, and joins the Kern River approximately 4 miles west of Bakersfield. The 152-mile-long Friant-Kern Canal is east of the alternative alignments. The canal capacity near Millerton Lake is 5,000 cubic feet per second (cfs) but decreases to 2,000 cfs in the southern portion of the valley as water is diverted for municipal, industrial, and agricultural use (ICF Jones & Stokes 2008). With the consent of the U.S. Bureau of Reclamation, Kaweah River water is occasionally pumped to the canal to relieve downstream flooding in the Tulare Lake bed. When the canal is full or downstream demand is low, the Friant-Kern Canal may not be used for flood control purposes (USACE 1996).

## 4.1.4 Hydrology

Of all the precipitation that falls within the Tulare Lake Basin, most of the runoff (over 98%) is collected in the Sierra Nevada and ends up within the Kings, Kaweah, Tule, and Kern rivers (Figure 4-3). The remaining runoff contributes to stream flows, including Deer Creek, White River, and Poso Creek. Hydrologically, the Tulare Lake Basin is essentially closed, because water only drains north to the San Joaquin River during periods of extremely high rainfall. The contributing rivers are normally dewatered (for agricultural uses) before reaching the Great Valley floor (USDA 1982).

### 4.1.4.1 Historical Hydrology

Historically, the Tulare Lake Basin was dominated by four large, shallow, mainly seasonal, terminal lakes: Tulare, Buena Vista, Goose, and Kern lakes (Figure 4-3). Historical Tulare Lake was originally one of the largest lakes in California, occupying much of southern Kings and Tulare counties and northern Kern County and encompassing up to 790 square miles during the wettest years (USDA 1986; EPA 2007). Tulare Lake was historically fed by the Kings River, Kaweah River (the source of Poso Creek), Tule River, and the Kern River from the Sierra Nevada. It was a terminal lake, having no natural outlet in dry years and overflowing to reach the San Joaquin River periodically during wet years (USDA 1982).

Buena Vista and Kern lakes were fed by the Kern River, which once flowed south and west across the southern Central Valley through a complex system of sloughs, creeks, ponds, and permanent wetlands. Goose Lake was fed by the overflow of a Kern River distributary and the overflow of Buena Vista Lake. In particularly wet years, Buena Vista Lake would overflow into the Buena Vista Slough, ultimately feeding into Tulare Lake (EPA 2007). Evaporation of these historic lakes through water diversions and climate change has resulted in a wide area of saline-sodic soils on the southern Central Valley floor. These soils support plants and plant communities tolerant of the saline and alkaline conditions.

Large portions of the southern Central Valley floor were historically subject to frequent flood events, from either intense fall/winter rainfall or from late-spring/early-summer snowmelt originating in the Sierra Nevada.

### 4.1.4.2 Present-Day Hydrology

The Tulare Lake Basin has changed dramatically in the past 150 years. Although many of the headwaters and mountains of the southern Sierra Nevada and the Coast Ranges have been protected, the effects of urbanization and human use increase toward the valley floor. All four of the major rivers have been dammed and much of the water flowing into the basin is diverted by numerous irrigation canals for agricultural use. The level of conversion has been so significant that Tulare Lake no longer exists; its bottom was reclaimed for farming and its water diverted.

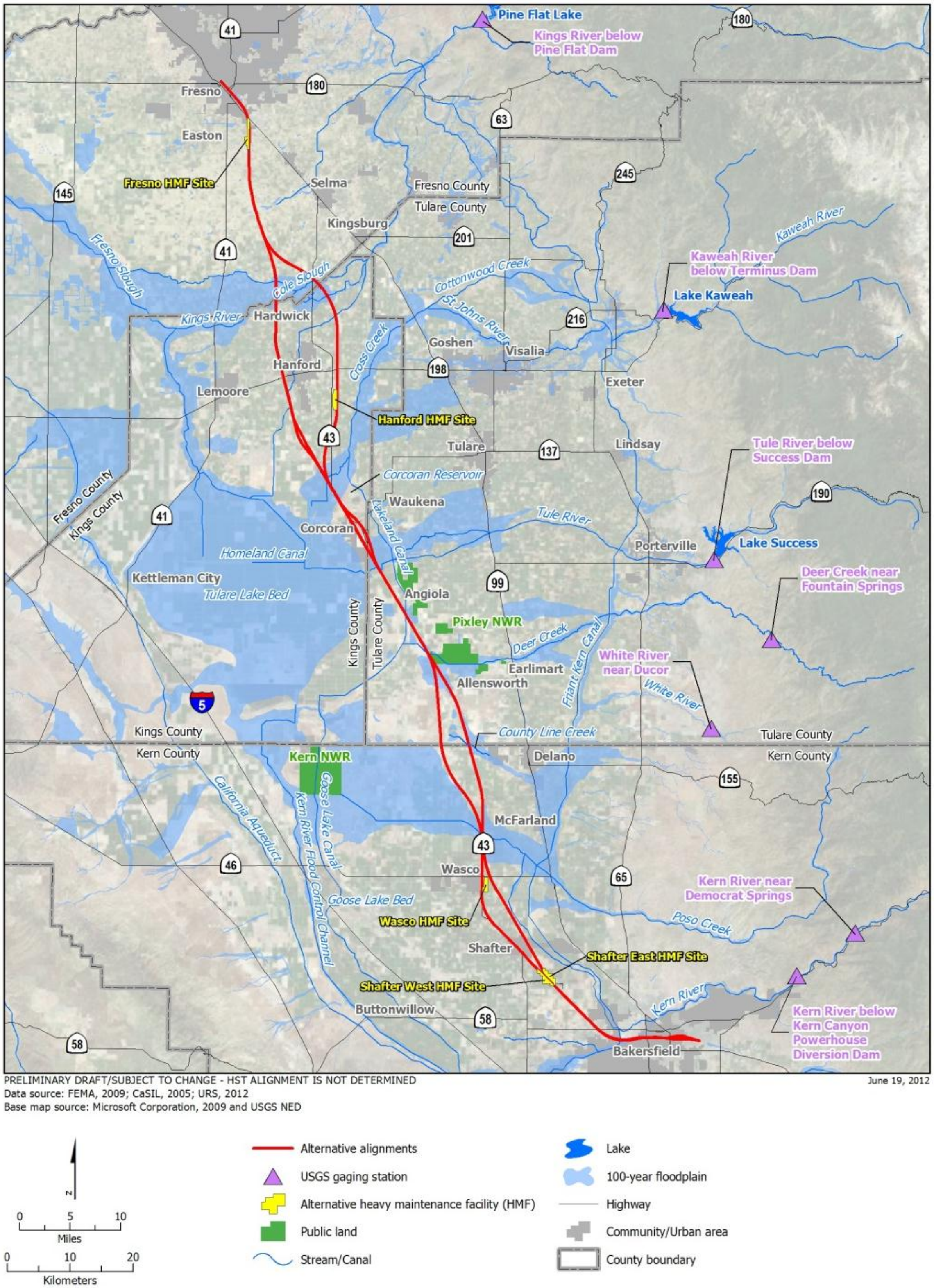



**Figure 4-3**
Floodplains and hydrology

The southern Central Valley once sustained rich riparian wetland habitats and shallow groundwater in the deltas of the major rivers (USDA 1982), but most of these habitats and the shallow groundwater are now greatly reduced or eliminated. More than 88% of wetlands and over 95% of the oak woodlands in the southern Central Valley have been converted to agriculture or urban use (Kelly et al. 2005). Much of the agriculture is supplied in the basin by the Friant-Kern Canal. This component of the federal Central Valley Project was built in the late 1940s (USDI Bureau of Reclamation 2011). This water conveyance system runs north-south through the eastern side of the basin, intersecting with all of the major rivers and creeks. The canal supplies water from the north to the drier southern areas. In high-water years, surplus flows are pumped into the Friant-Kern Canal to minimize flood risk (EPA 2007). The California Aqueduct runs through the western side of the Tulare Basin. This system delivers water from the state's California Water Project and the federal Central Valley Project (the water is diverted in the Sacramento–San Joaquin Delta directly to water consumers in the southern Central Valley and Southern California).

The water flowing into the valley floor provides critical beneficial uses, primarily irrigation for agriculture. California's Department of Water Resources estimates that about 84% of the water in the Tulare Lake region is used for agriculture, 5% is used for urban uses, and the remaining 11% is available for environmental uses, including wildlife and fish habitat (DWR 2005).

Regular flooding is now largely controlled by dams, diversions, levees, and dredging. The previous floodplain and riparian habitat have also largely been replaced by agriculture or urban development. Infrequent but catastrophic floods now occur in parts of the southern Central Valley; these floods are made more severe by the loss of the flood-attenuating functions of riparian and wetland habitats (USDA 1982; Vileisis 1997).

At the project level, all of the streams and rivers within the Fresno to Bakersfield alternative alignments have been dredged, culverted, diverted, dewatered, channelized, or have had their active floodplains severely reduced by levee construction. Therefore, most of the surface water in the project footprint is found in irrigation canals, ditches, or water retention/detention basins, and occasionally in river channels or in precipitation-fed wetlands and vernal pools. The remaining wetlands are largely unrelated to the historical floodplains or regional aquifers.

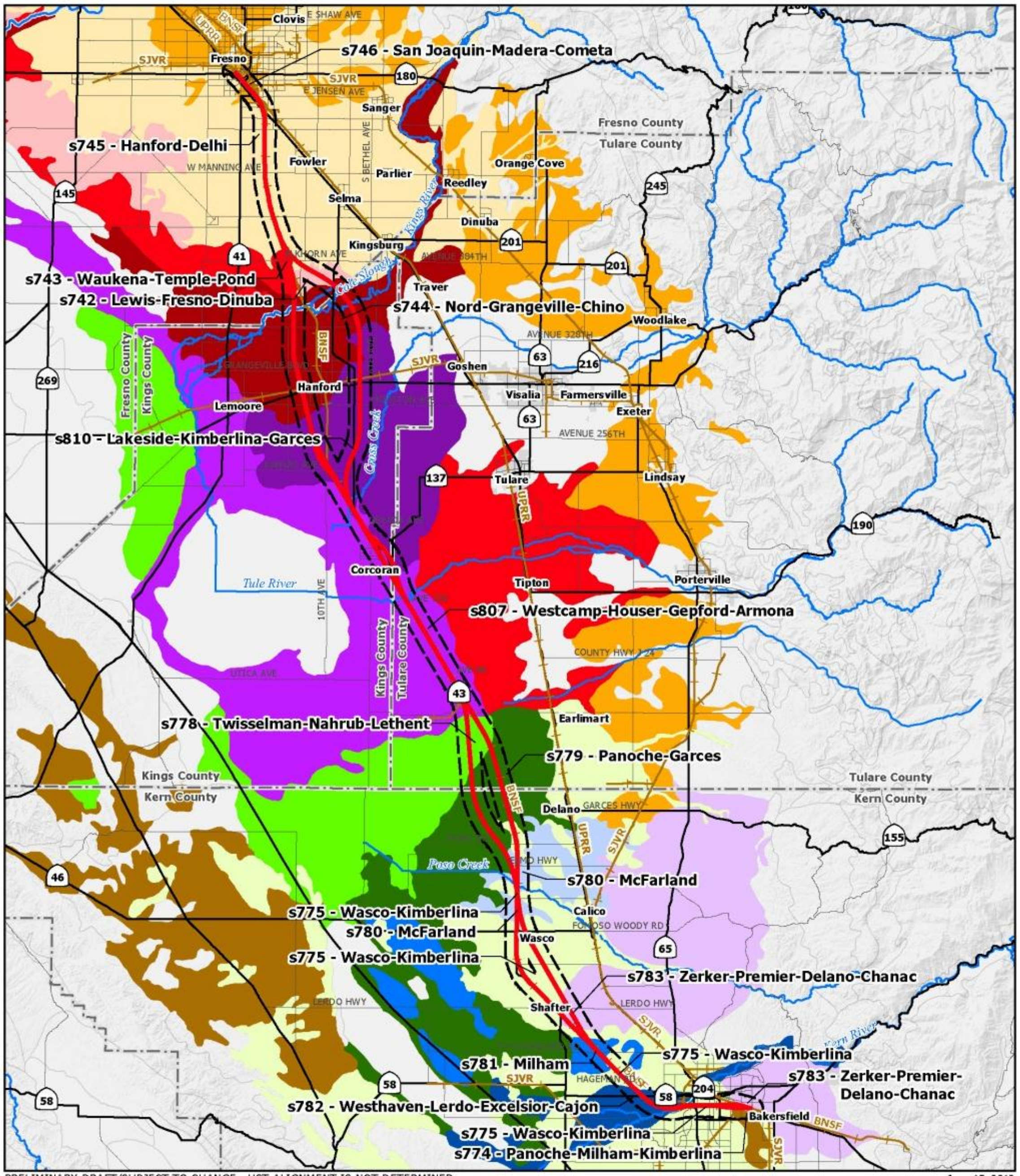
### 4.1.5 Soils

The soils underlying the project alternatives, the station alternatives, and the HMF alternatives are described in Natural Resources Conservation Service (NRCS) soil surveys; these soils consist primarily of alluvial deposits of clay, silt, sand, and gravel with varying grain sizes and content (USDA-NRCS 2006). The soil types and consistencies of these deposits vary by location and depend on how the soils were deposited. The surface soils in the project vicinity generally have high permeability and infiltrate runoff relatively quickly. This soils information is based on conditions within the upper 4 to 5 feet of the ground surface. Table 4-1 provides a summary of the physiographic features, soil associations, and counties of occurrence. Figure 4-4 shows the soil associations in the study area.

**Table 4-1**
Summary of Soil Associations

| Soil Association | Counties of Occurrence | Landform Groups | Potential Soil Hazard Characterization |
|---|---|---|---|
| San Joaquin-Madera-Cometa | Fresno | Low alluvial terraces | No to moderate erosion potential; low to high shrink-swell potential; high corrosivity potential |
| Hanford-Delhi (also identified as $Q_{sd}$ (sand dunes) on Figure 3.9-1 in the Revised Draft EIR / Supplemental Draft EIS) | Fresno | Young alluvial fans and alluvial benches, | No to slight water erosion potential; slight to moderate wind erosion potential; low shrink-swell potential; low corrosivity potential |
| Waukena-Temple-Pond | Fresno | Basin floodplain | No to slight water erosion potential; slight wind erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential |
| Lewis-Fresno-Dinuba | Fresno | Alluvial fans/valley plains | No to slight erosion potential; low to moderate shrink-swell potential; high corrosivity potential |
| Nord-Grangeville-Chino | Fresno/Kings | Lower parts of recent alluvial fans and floodplains | No to slight erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential |
| Lakeside-Kimberlina-Garces | Kings/Tulare | Alluvial fans | Slight water erosion potential; low to high shrink-swell potential; slight to moderate wind erosion potential |
| Westcamp-Houser-Gepford-Armona | Kings/Tulare | Low alluvial fans, basins, and floodplains | Slight wind erosion potential, moderate to high water erosion potential; low to high shrink-swell potential; high corrosivity potential |
| Twisselman-Nahrub-Lethent | Tulare | Basin rims and fan remnants | Moderate to high water erosion potential; moderate wind erosion potential; low to moderate shrink-swell potential; high corrosivity potential |
| Panoche-Garces | Tulare/Kern | Alluvial fans and floodplains | Slight water erosion potential; slight to moderate wind erosion potential; low to moderate shrink-swell potential |
| McFarland | Kern | Alluvial fans and floodplains | Slight water erosion potential; low to moderate shrink-swell potential; high corrosion potential to uncoated steel |
| Wasco-Kimberlina | Kern | Alluvial fans, fan skirts, and plains | Slight water erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential |
| Zerker-Premier-Delano-Chanac | Kern | Alluvial plains and terraces | Low shrink-swell potential; low wind erosion potential |
| Milham | Kern | Alluvial fans | Low to moderate erosion potential; low to moderate shrink-swell potential |
| Westhaven-Lerdo-Excelsior-Cajon | Kern | Alluvial fans and fan skirts | Moderate to high erosion potential; slight wind erosion potential; low shrink-swell potential |
| Panoche-Milham-Kimberlina | Kern | Alluvial fans, plains, and low terraces | Local moderate water erosion potential; high corrosivity potential to uncoated steel |

Source: USDA-NRCS 2006.
[a] As mapped by USDA-NRCS 2006. Refer to Figure 3.9-2 in the Revised Draft EIR / Supplemental Draft EIS for the locations of soil associations (Authority and FRA 2012a).




PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: U.S. Department of Agriculture, Natural Resources Conservation Service, 2006
Note: Only soil within 1-mile buffer of alignments displayed in legend.

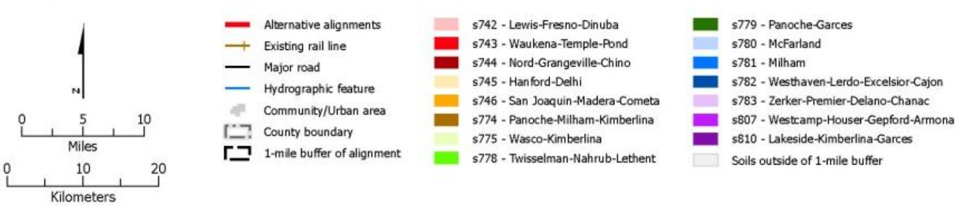



**Figure 4-4**
Soil associations

The soils within the study area generally occur in one of the physiographic locations (Figure 4-5). The characteristics of the physiographic locations and the associated soils are summarized below:

- Alluvial fans and floodplains. These soils are found in Fresno, Kings, Tulare, and Kern counties. Alluvial fans are fan-shaped deposits of water-transported material (alluvium). They typically form at the base of topographic features where there is a marked break in slope. Consequently, alluvial fans tend to be coarse-grained, especially at their mouths where the energy of the stream or river is still high. At their edges, however, where energy levels can be low to quiescent, they can be relatively fine-grained. These soils are developed in nearly level and gently sloped ground conditions, along drainage ways, on alluvial fans, and on floodplains. Characteristics often vary greatly within short distances because the soils developed in compositionally variable stream deposits. Some areas may have compacted silt or sand or an iron-silica hardpan. Typically, these soils have little clay content, exhibit low to moderate shrink-swell potential, are moderately to highly corrosive to uncoated steel, and are slightly corrosive to concrete. These soils also have slight potential for water and wind erosion. Sand dunes have been identified in the area south of Fresno (see Figure 4-5).

- Low alluvial terraces. These soils are found in Fresno and Kern counties. They are often found in rolling topography and can include a strongly cemented or indurated hardpan in the subsoil. The hardpan can be composed of cemented silica or clay. These soils contain expansive clays, resulting in moderate to high shrink-swell potential. These soils are highly corrosive to uncoated steel and moderately corrosive to concrete. They can have a moderate potential for water erosion and a high potential for wind erosion.

- Basin areas (including saline-alkali basins). These soils are found primarily in Kings, Tulare, and the northern portion of Kern counties. The topography of these areas is nearly level or gently undulating. They have more clay content than fans and terraces, and nearly all have accumulations of salt and alkali due to poor drainage. Most of these soils have cemented lime-silica hardpans in the subsoil. These soils exhibit low to high shrink-swell potential, are highly corrosive to uncoated steel, and are moderately corrosive to concrete. They are also moderately to highly susceptible to water and wind erosion.

## 4.2 Biological Conditions

Historically, the Central Valley was characterized by California prairie, marshlands, valley oak savanna, and extensive riparian woodlands (Hickman 1993). Today, more than 80% of the Central Valley is covered by farms and ranches (USDA-NRCS 2006). Overall, the study area is highly disturbed and fragmented because of urban, agricultural, railroad, highway, and local road land cover types. In a few areas, native vegetation remains relatively undisturbed, though invasive and non-native plant species may occur in these areas. If these areas have not been recently plowed or disked or if they show no sign of having been disturbed in recent decades, they are referred to as "natural areas" in this document.

This section describes the terrestrial habitat, land uses, and aquatic resources, including man-made and manipulated aquatic resources, sensitive aquatic resources, and special areas and conservation lands in the study area or in close proximity to the study area. The terrestrial habitats and land uses are based on the California Wildlife Habitat Relationships System (CDFG 2008; Mayer and Laudenslayer 1988) and conditions observed in the field assessments. Aquatic resources are as described in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (FRA and Authority 2012a).

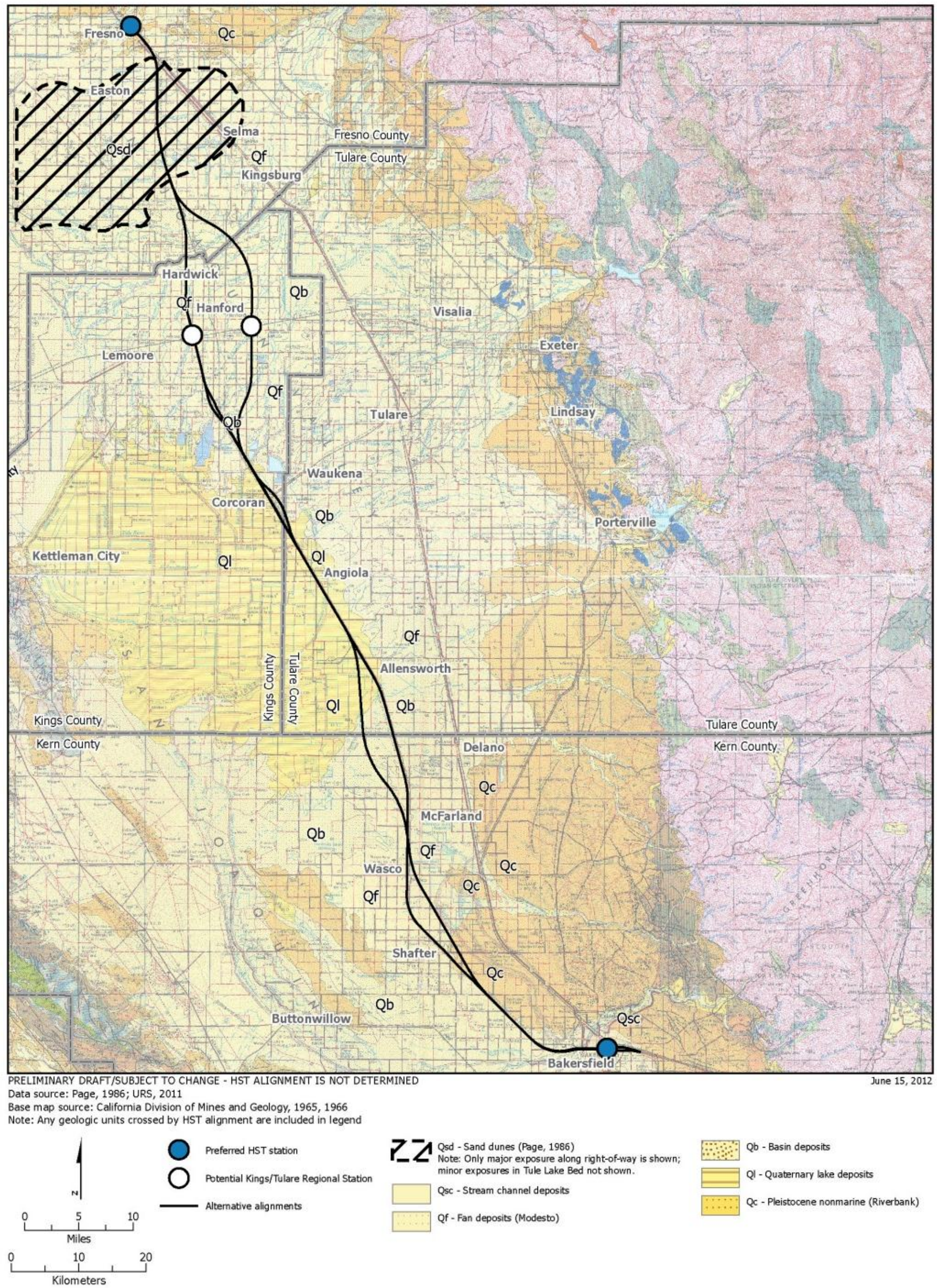



**Figure 4-5**
Physiographic characteristics

### 4.2.1 Terrestrial Habitats and Land Uses

The categories of terrestrial plant communities and land cover types that occur in the study area are summarized below. The plant communities and land cover types identified in the study area include agricultural lands, developed areas, semi-natural areas, and natural areas (Figure 4-6). Habitat conditions in the study area are discussed in detail in *Fresno to Bakersfield Section: Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b).

The following descriptions of plant communities and land cover types are based on *A Guide to the Wildlife Habitats of California* (Mayer and Laudenslayer 1988) and the California Wildlife Habitat Relationships System (CDFG 2008).

#### 4.2.1.1 Agricultural Lands

Eight types of agricultural land are found in the study area: cropland, dryland grain crops, irrigated grain crops, irrigated hayfield, irrigated row and field crops, deciduous orchard, evergreen orchard, and vineyard. These land uses, along with urban land uses, characterize the overwhelming majority of land in the study area. Agricultural lands may provide marginal habitat for seasonal forage and refugia for a limited number of common species and special-status species. Ruderal plant species, which are defined as species that grow where the natural vegetation has been removed or significantly degraded by past or current human activity, are found in these agricultural land types, especially where these types are bordered by roads, canals, ditches, or other highly disturbed features. Vegetation in these areas is highly variable but often includes a mix of non-native annual grasses such as ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis* ssp. *rubens*), wild oats (*Avena* spp.), Italian ryegrass (*Lolium multiflorum*), and smooth barley (*Hordeum murinum*) and weedy forbs such as bur clover (*Medicago polymorpha*), redstem filaree (*Erodium cicutarium*), yellow star thistle (*Centaurea solstitialis*), Russian thistle (*Salsola tragus*), tumbleweed, (*Amaranthus albus*), Johnson grass (*Sorghum jalapense*), and silver-leaf horsenettle (*Solanum elaeagnifolium*).

Some agricultural species have become naturalized outside the areas where they are planted. These include black mustard (*Brassica nigra*), rape mustard (*Brassica rapa*), Johnson grass (*Sorghum jalapense*), cultivated timothy (*Phleum pretense*), common barley (*Hordeum vulgare*), common wheat (*Triticum aestivum*), and peach (*Prunus persica*). Native species that also occur in ruderal areas in agricultural lands often consist of saltgrass (*Distichlis spicata*), fiddleneck (*Amsinckia menziesii* var. *intermedia*), Canada horseweed (*Conyza canadensis*), annual sunflower (*Helianthus annuus*), alkali mallow (*Malva leprosa*), and tarplants (*Hemizonia* spp.). Field and row crops such as alfalfa provide foraging habitat for raptors, particularly Swainson's hawks (*Buteo swainsoni*). Fallow fields and inactive farmland may provide nesting habitat for several wildlife species, including northern harrier (*Circus cyaneus*) and western burrowing owl (*Athene cunicularia*). These and other agricultural lands may provide foraging or dispersal habitat for loggerhead shrike (*Lanius ludovicianus*), white-tailed kite (*Elanus leucurus*), and American badger (*Taxidea taxus*).

#### 4.2.1.2 Developed Areas

Developed areas are characterized by various types of cover, including barren and urban (e.g., commercial/industrial, and transportation corridors. These areas generally include landscaped areas, yards, and various outbuildings and provide low-quality resources for wildlife. However, certain species, such as the American peregrine falcon (*Falco peregrinus anatum*) and western mastiff bat (*Eumops perotis californicus*) have adapted to developed areas and may use these areas for nesting or roosting habitat.

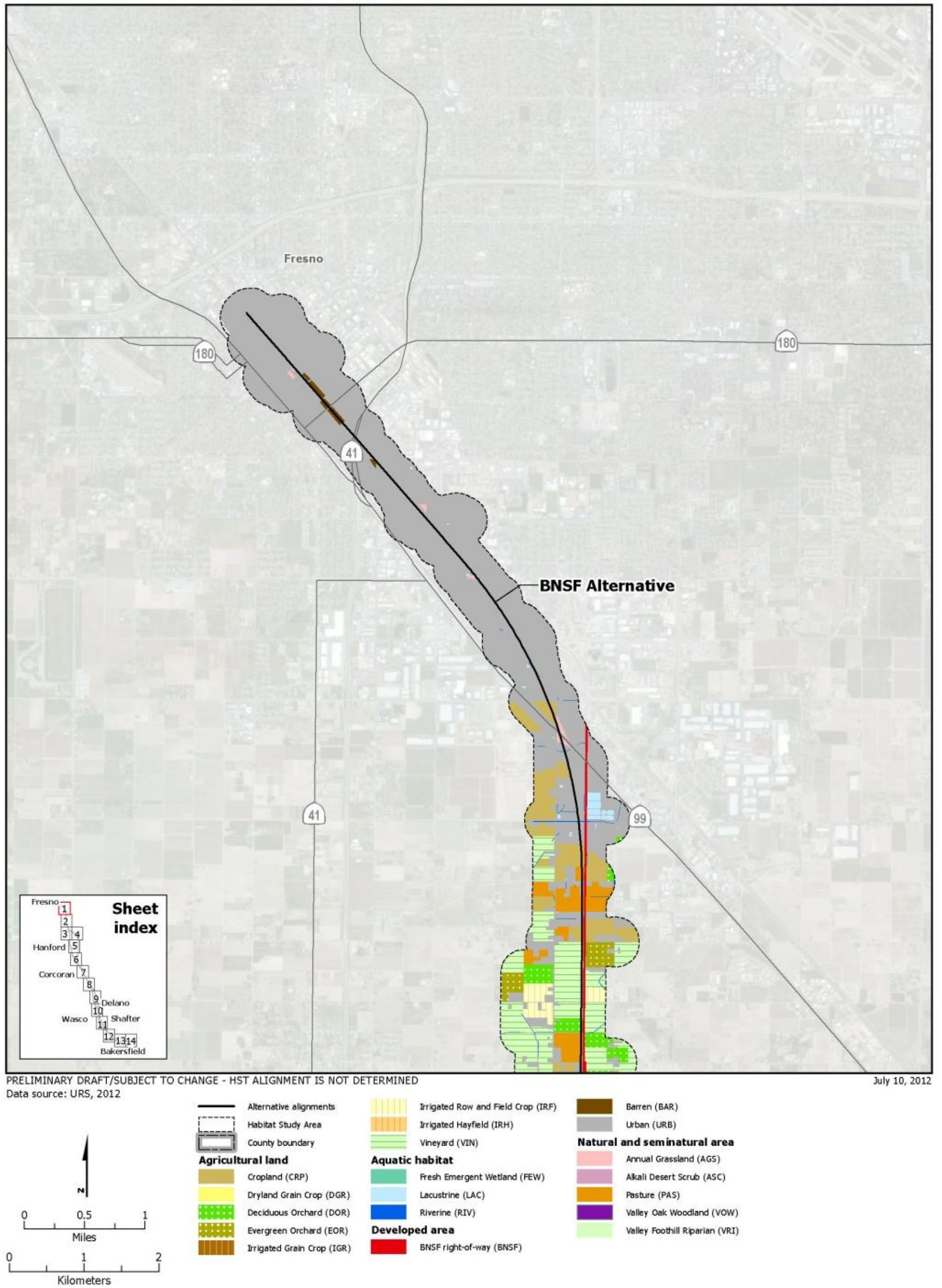



**Figure 4-6**
Wildlife habitat types (14 Sheets)

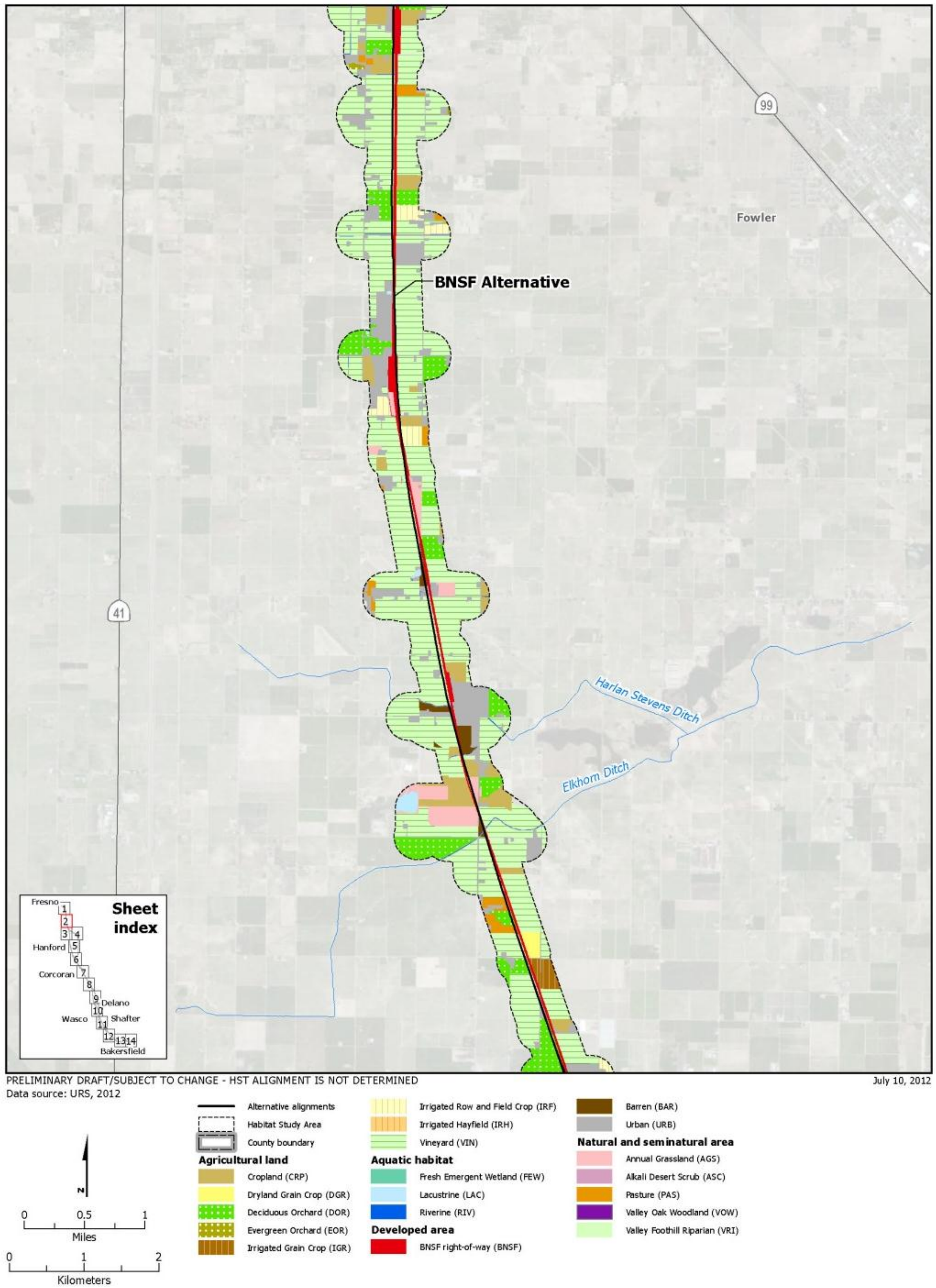



**Figure 4-6**
Wildlife habitat types (Sheet 2)

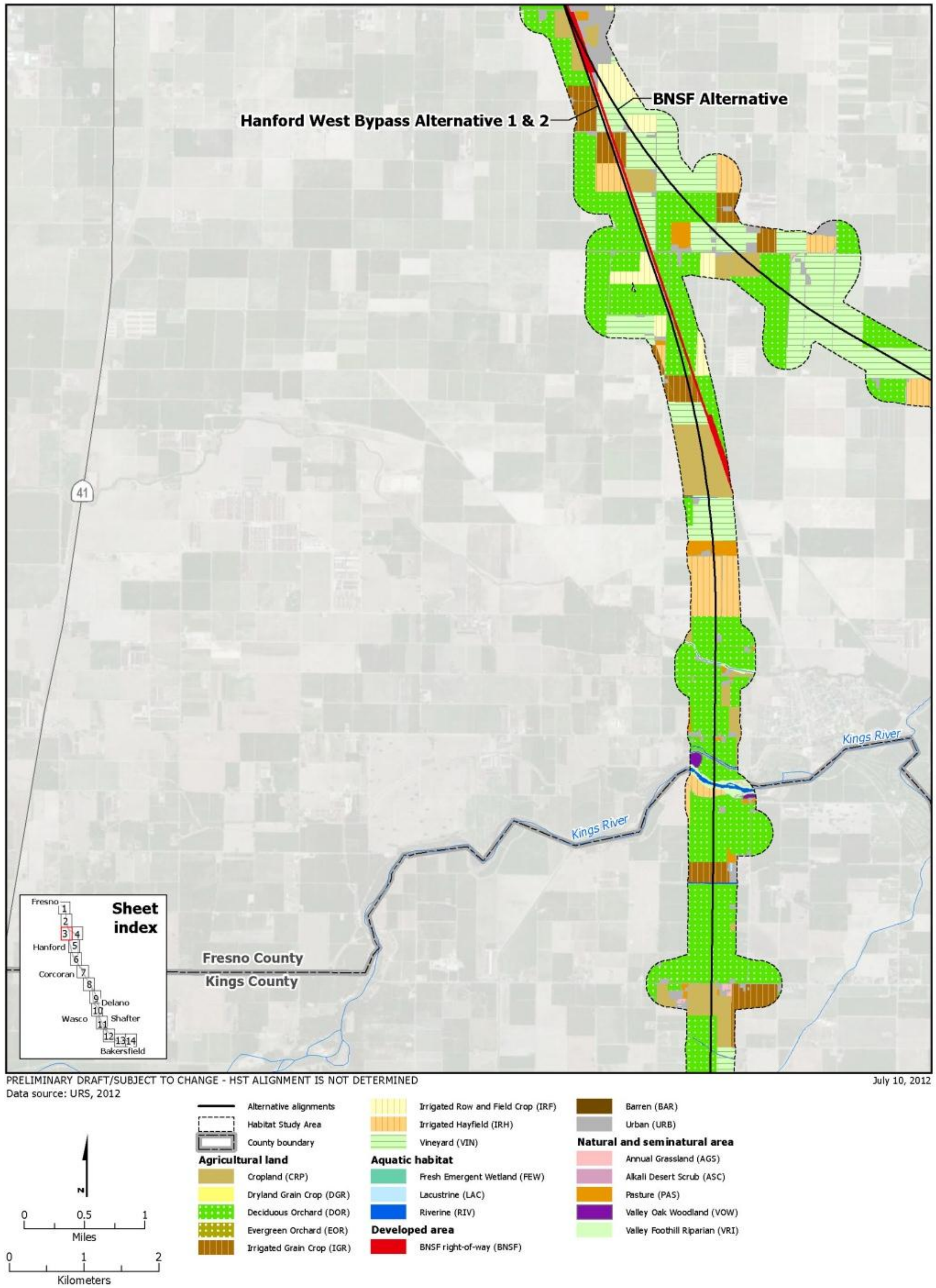



**Figure 4-6**
Wildlife habitat types (Sheet 3)

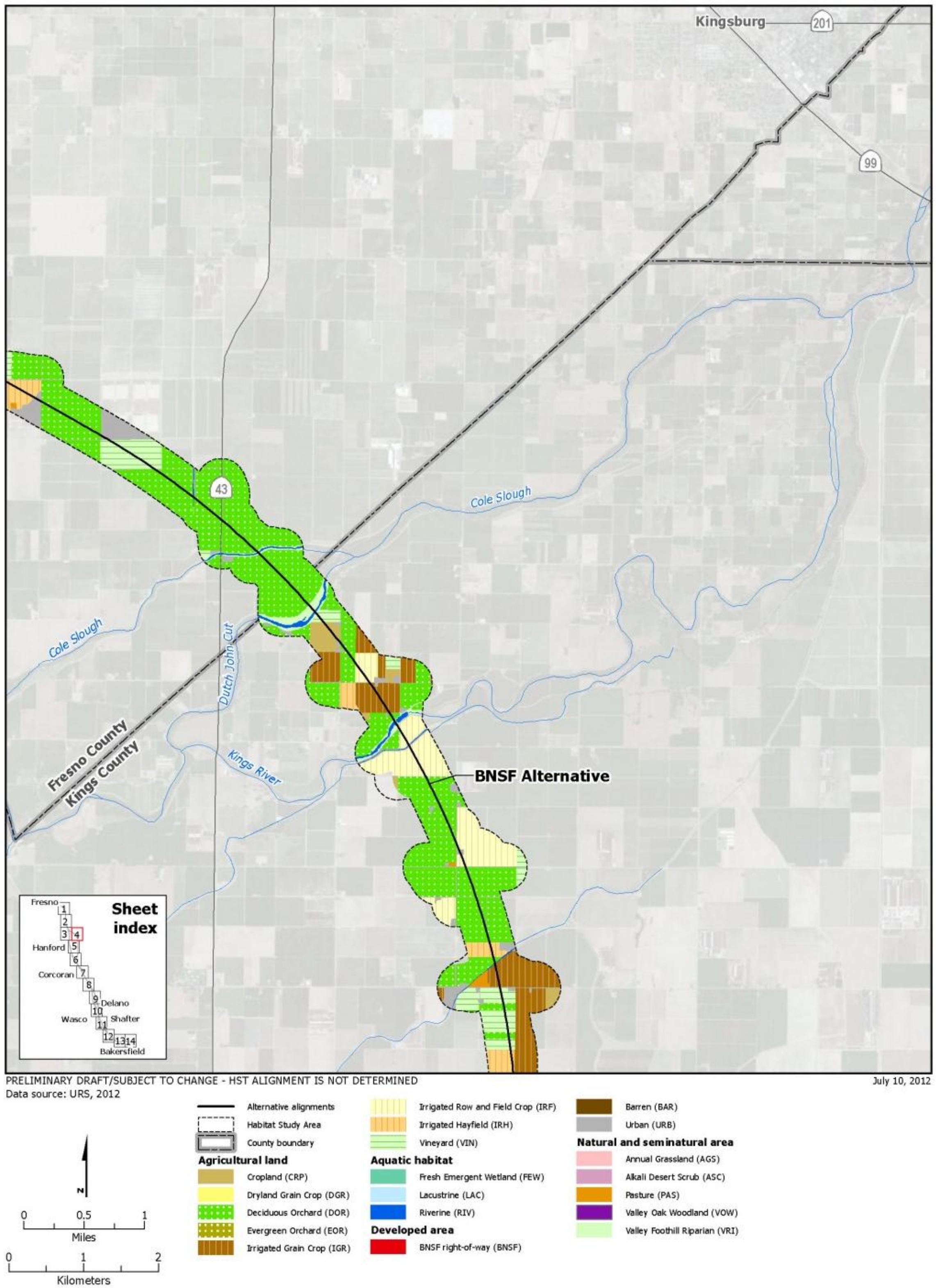



**Figure 4-6**
Wildlife habitat types (Sheet 4)

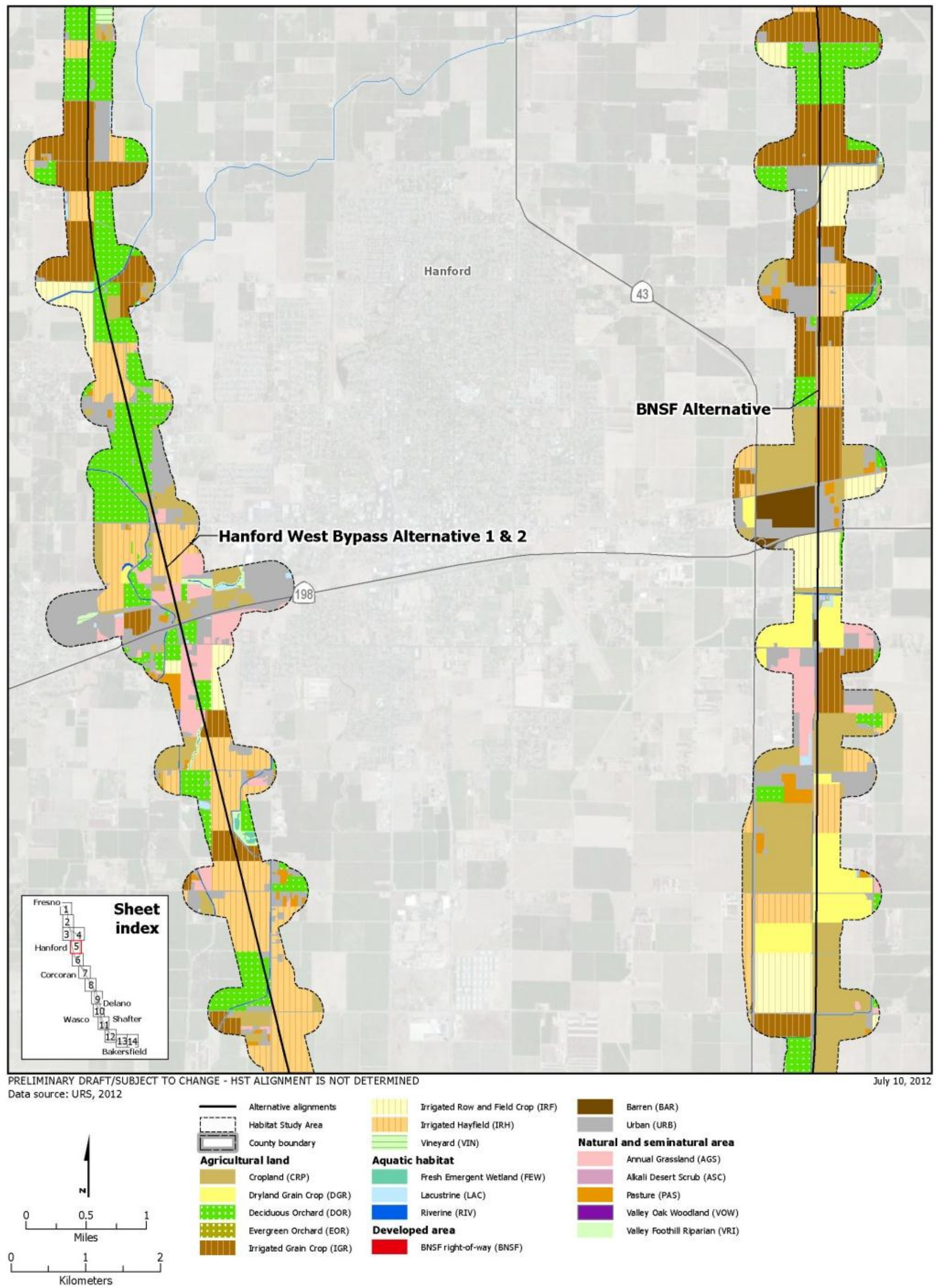



**Figure 4-6**
Wildlife habitat types (Sheet 5)

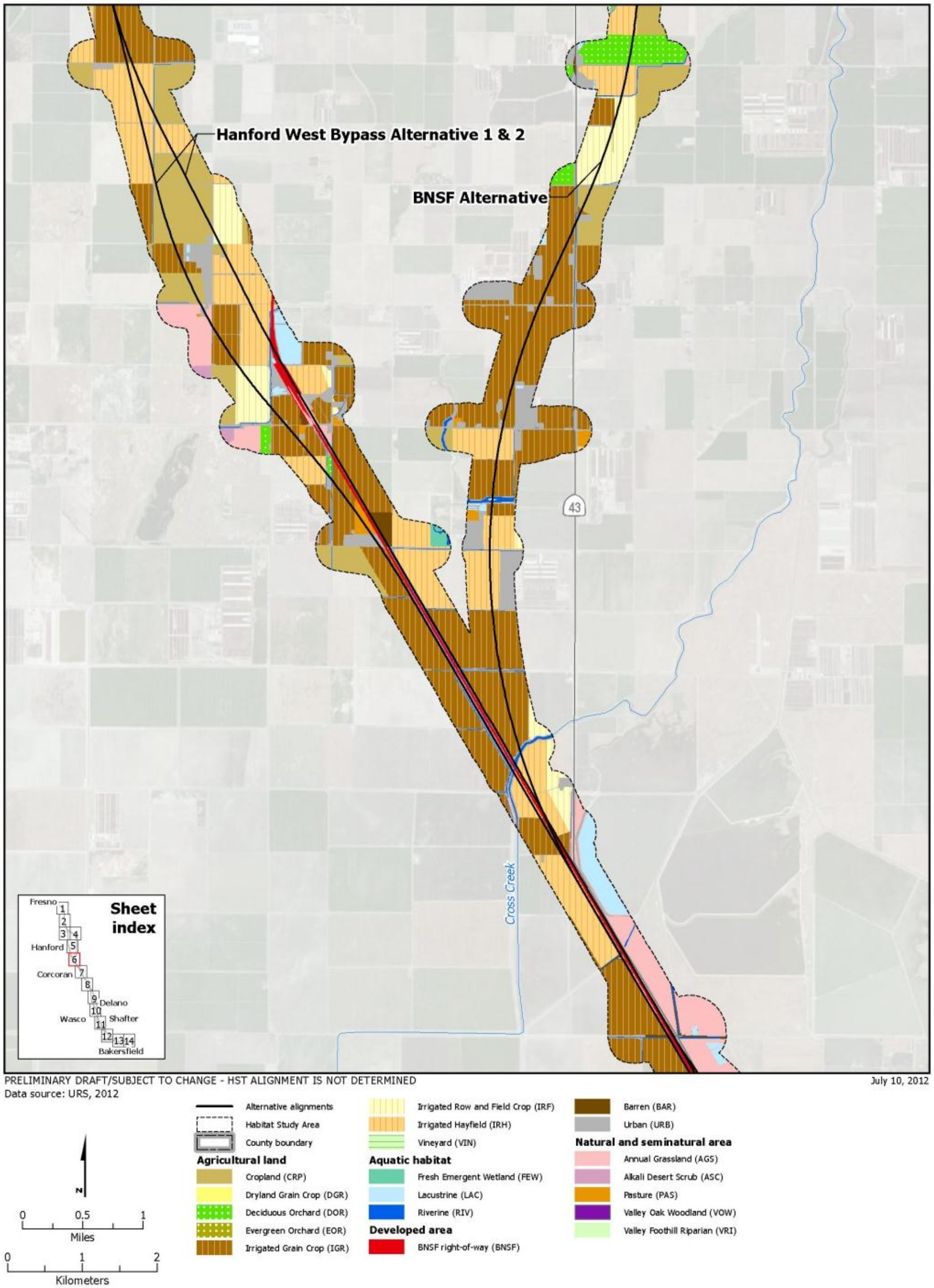



**Figure 4-6**
Wildlife habitat types (Sheet 6)

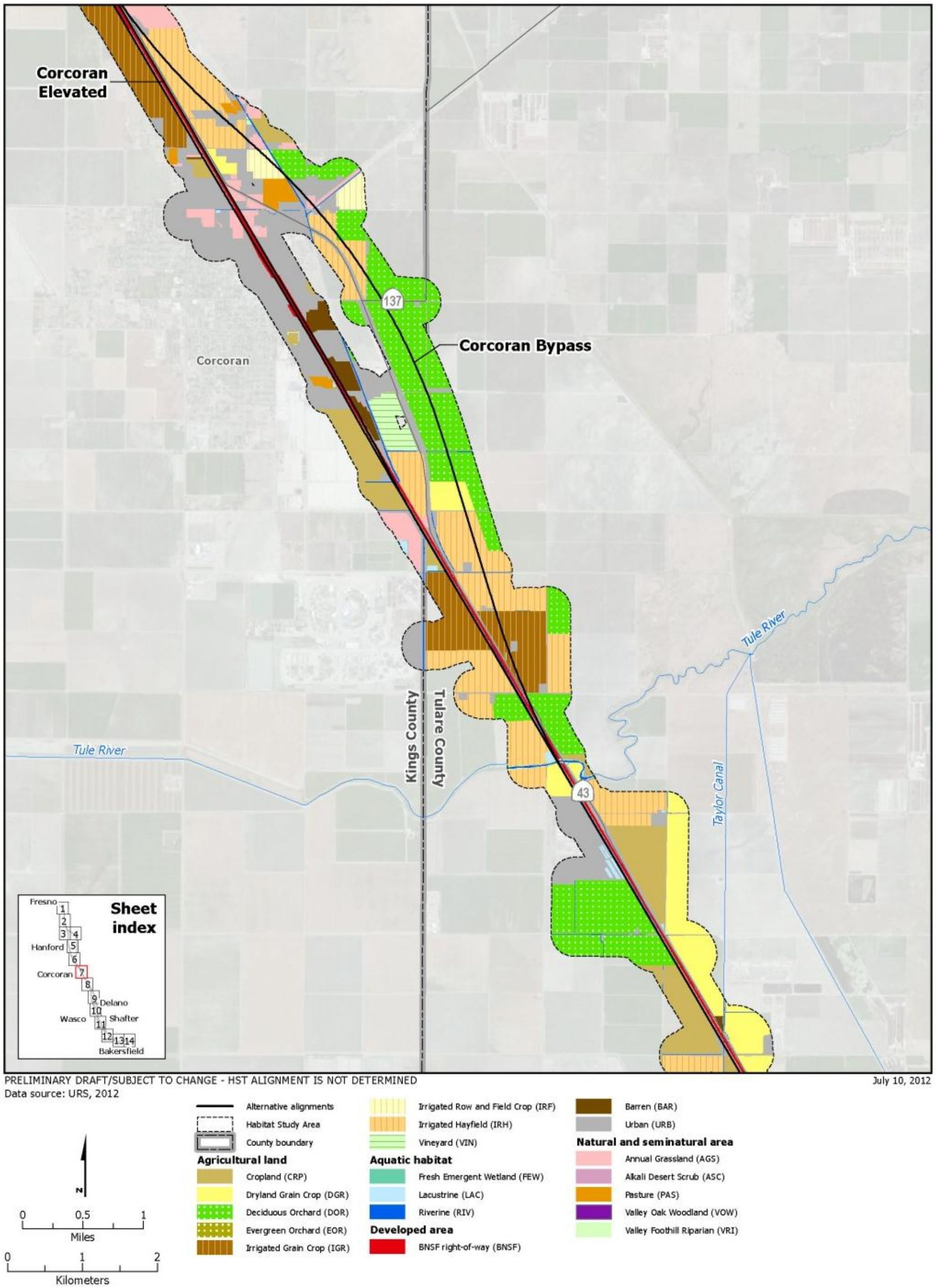



**Figure 4-6**
Wildlife habitat types (Sheet 7)

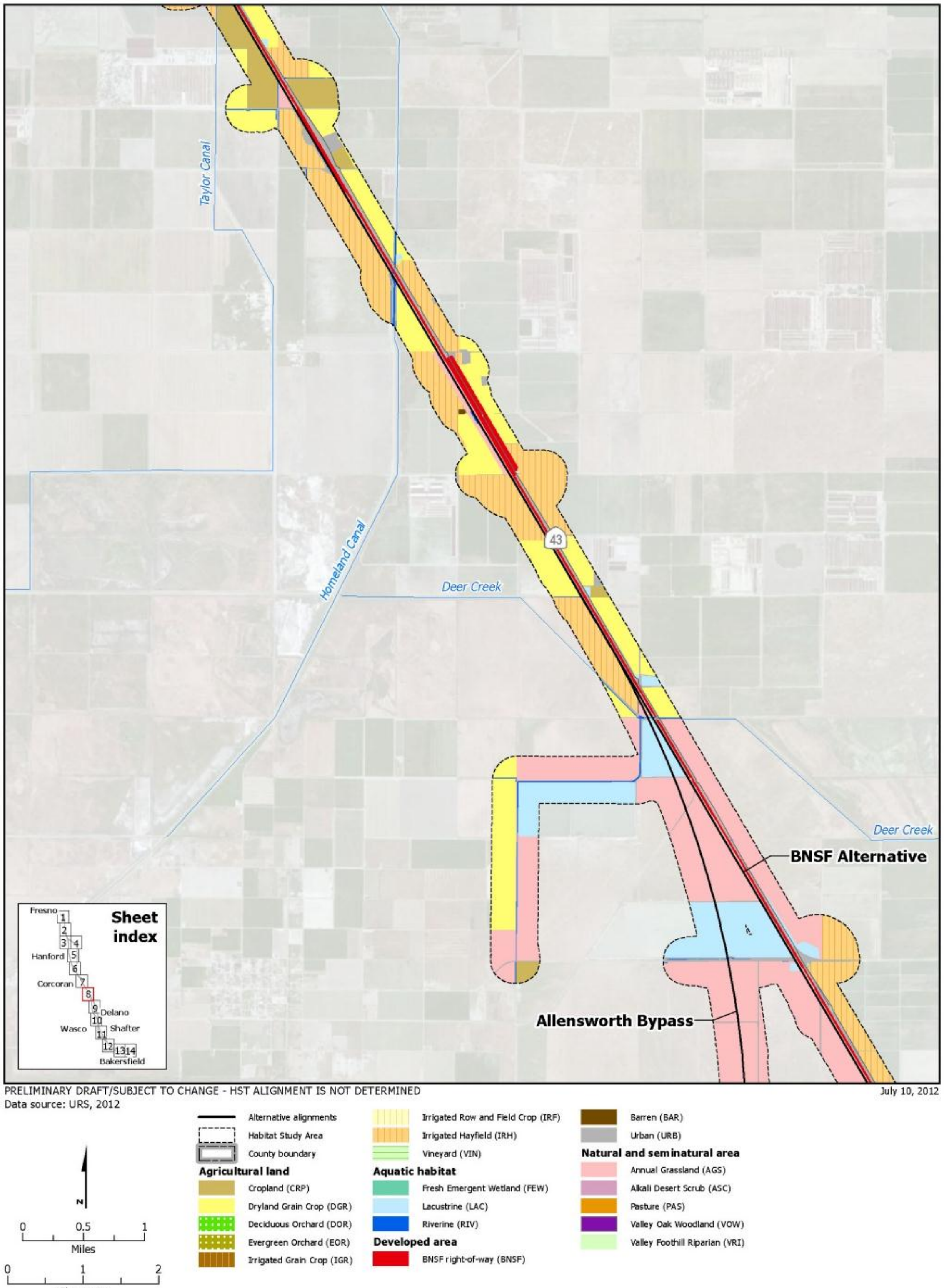



**Figure 4-6**
Wildlife habitat types (Sheet 8)

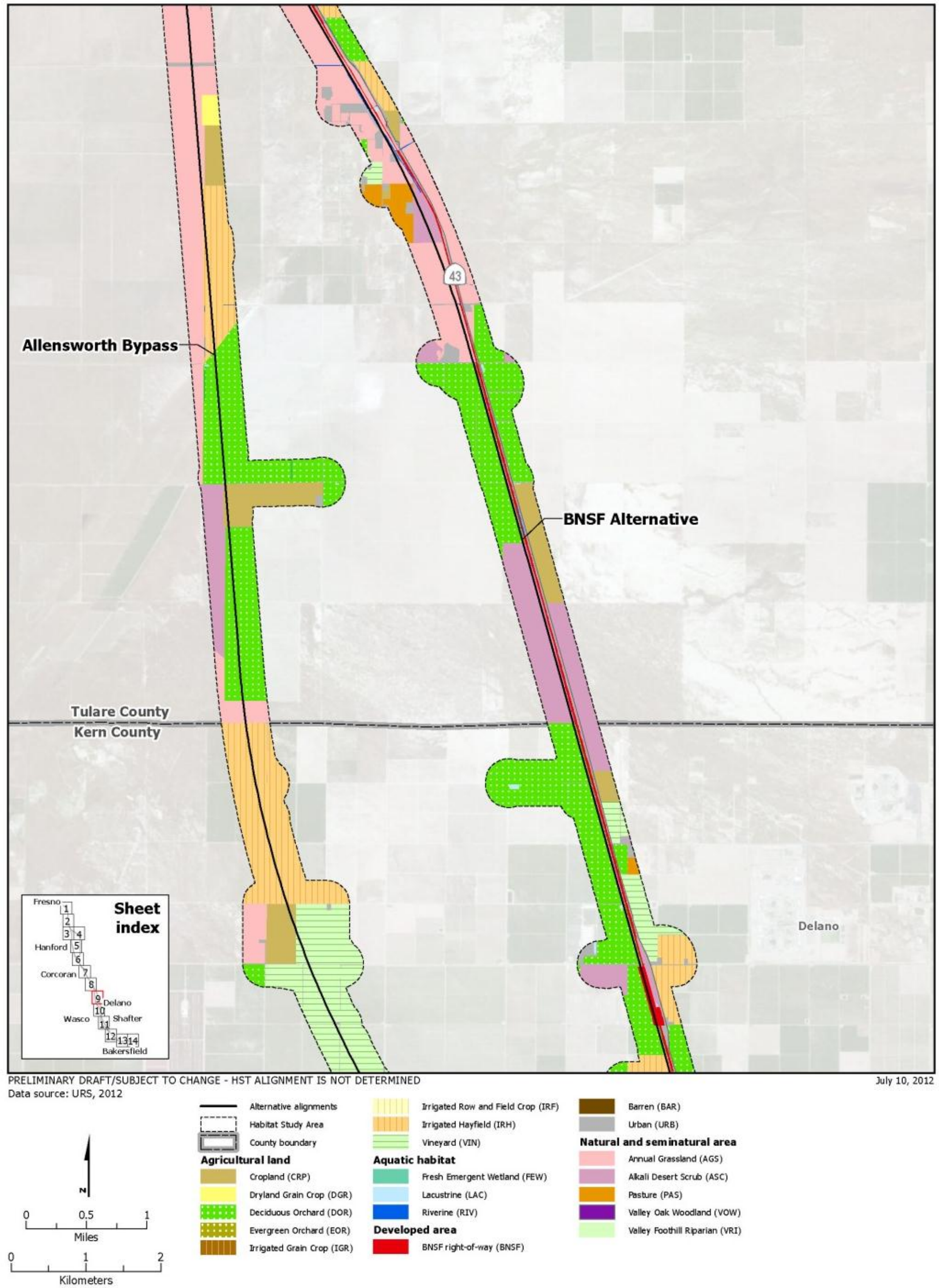



**Figure 4-6**
Wildlife habitat types (Sheet 9)

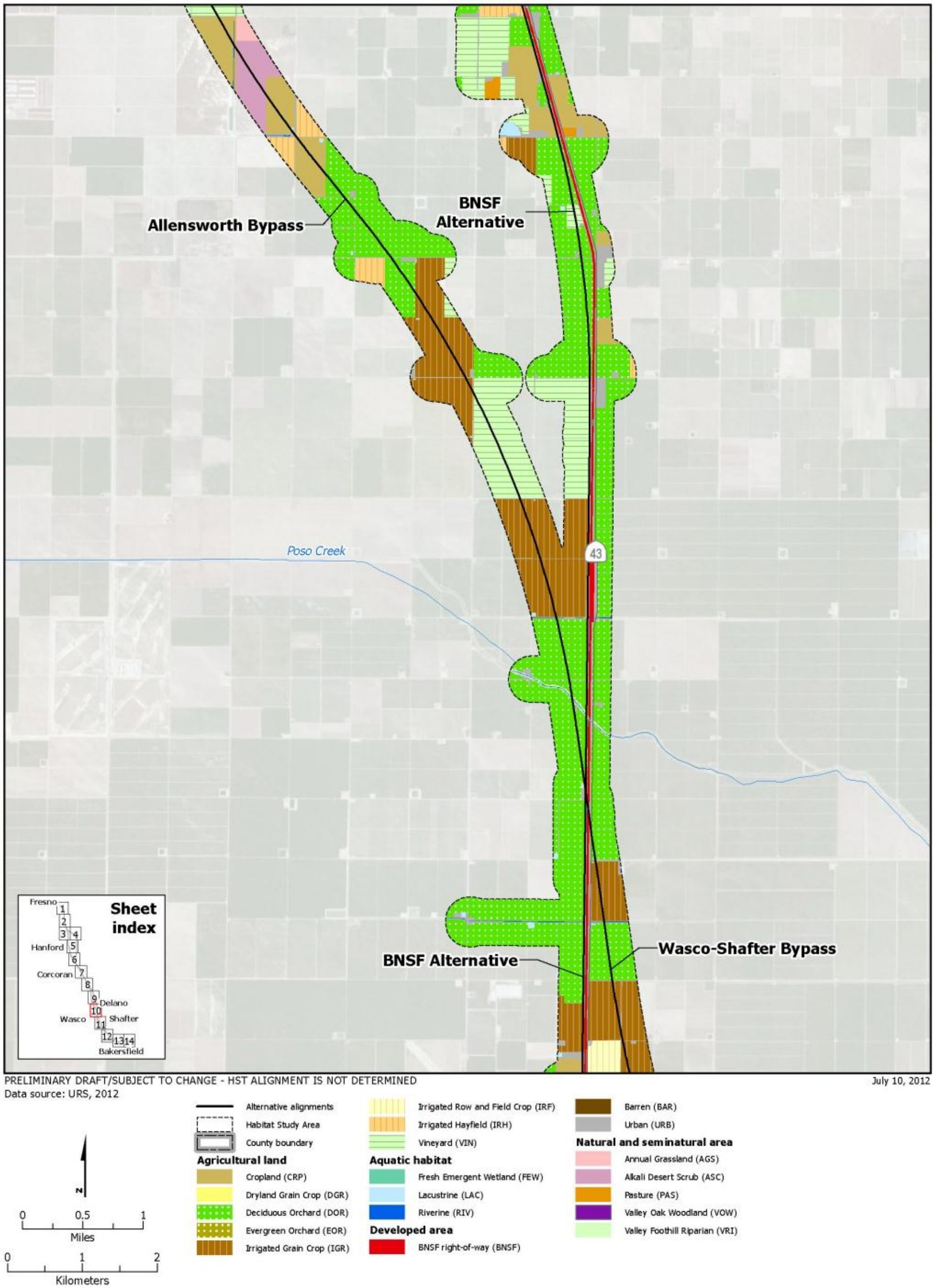



**Figure 4-6**
Wildlife habitat types (Sheet 10)

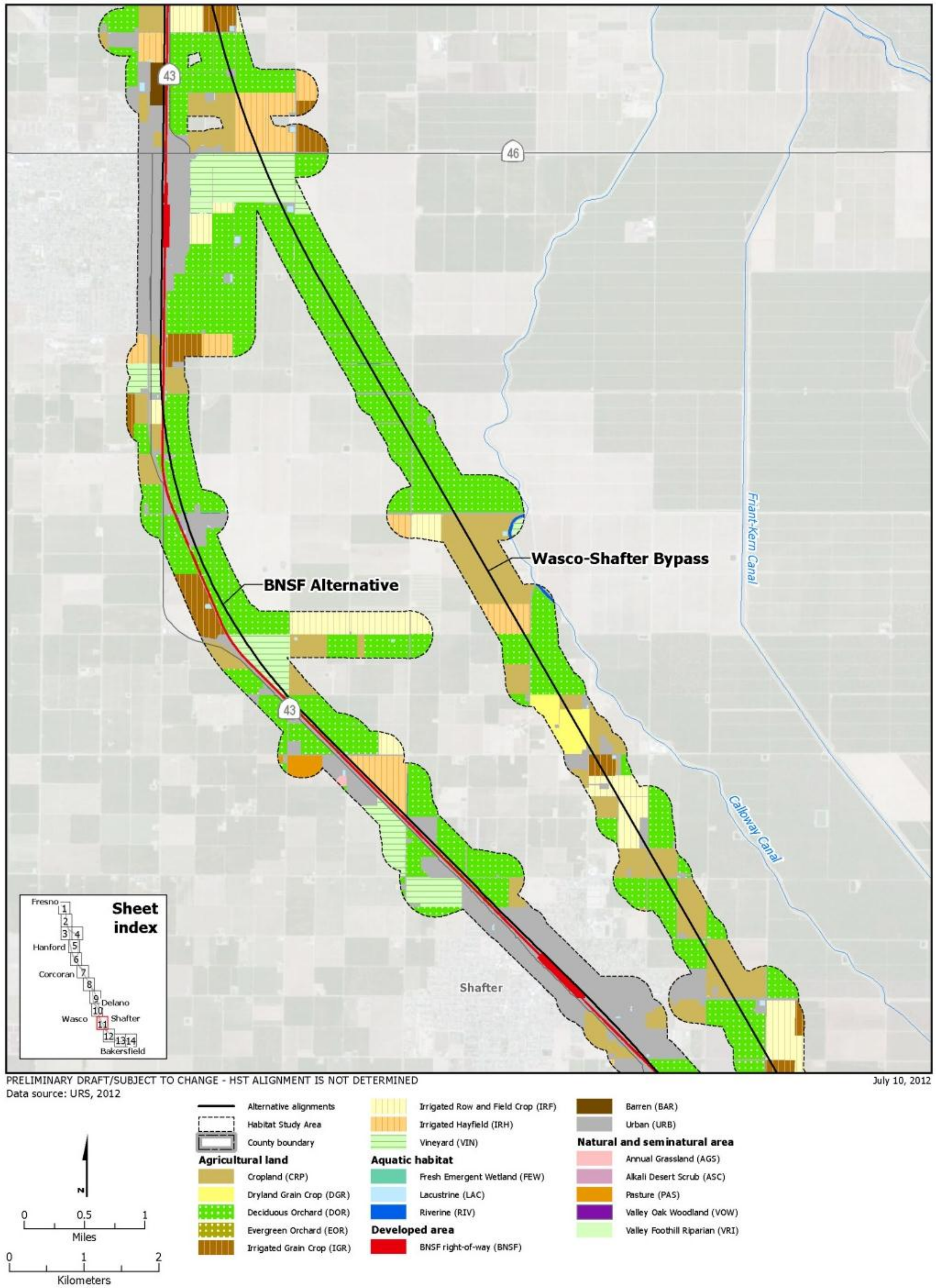



**Figure 4-6**
Wildlife habitat types (Sheet 11)

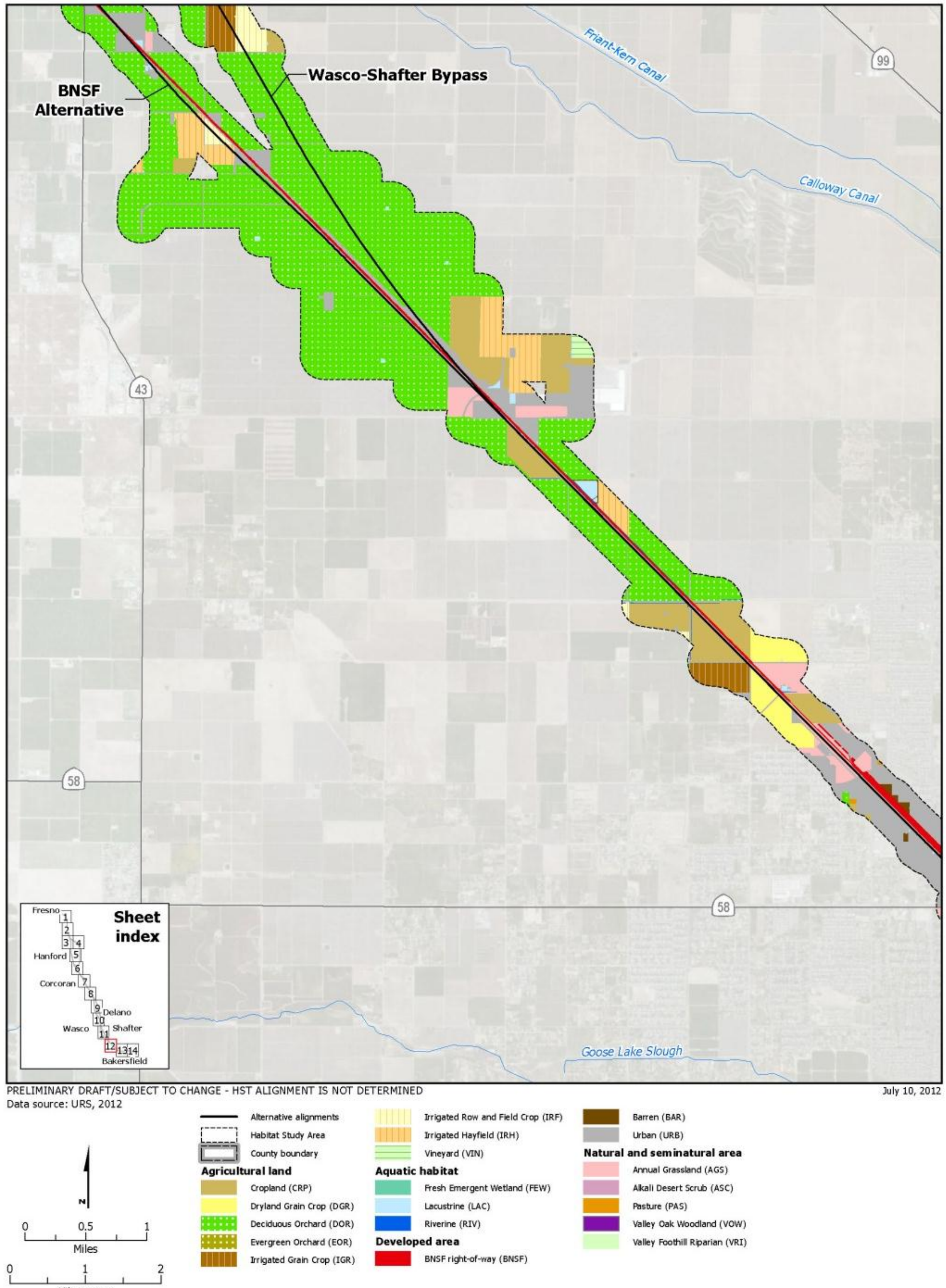



**Figure 4-6**
Wildlife habitat types (Sheet 12)

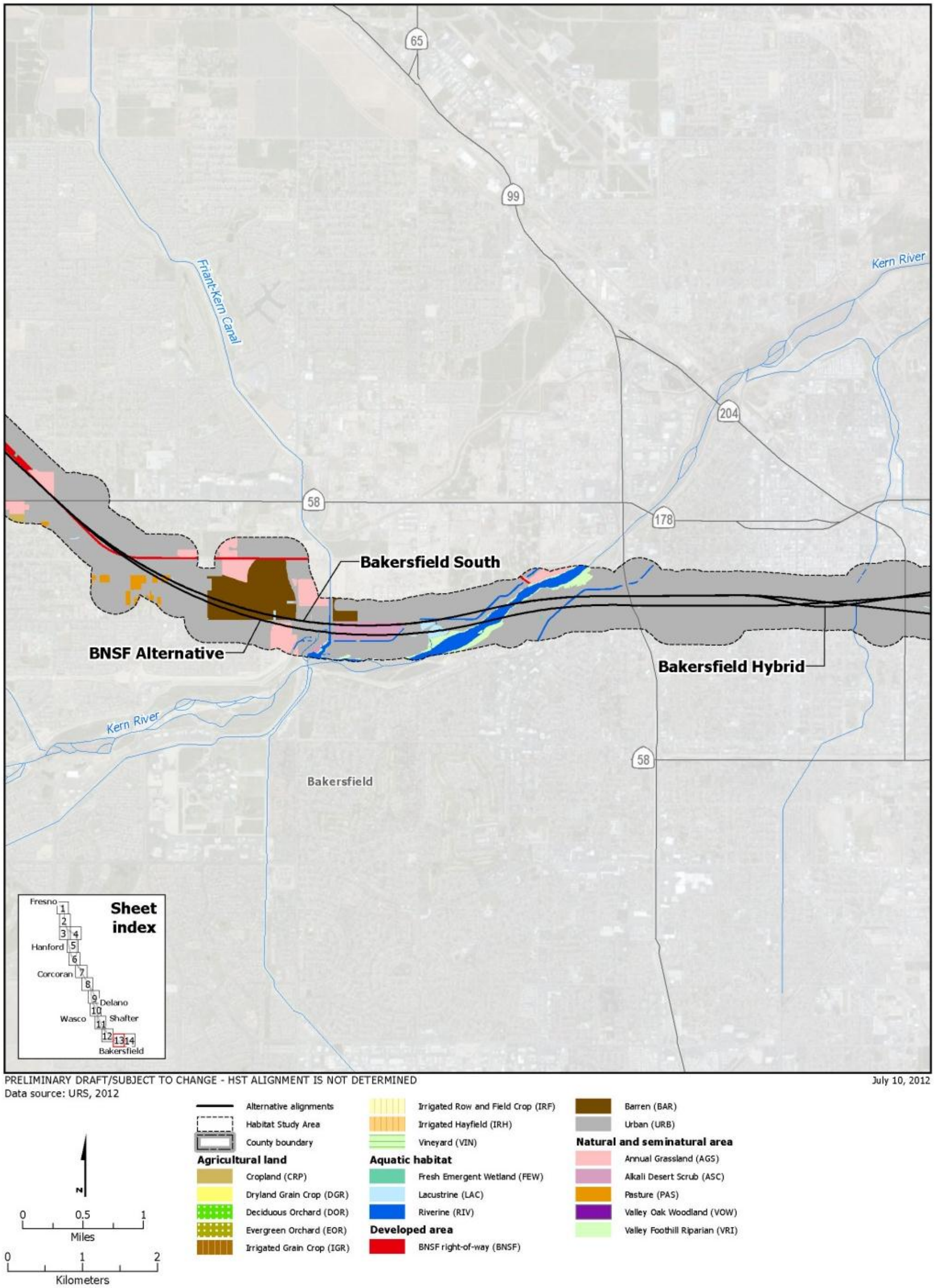



**Figure 4-6**
Wildlife habitat types (Sheet 13)

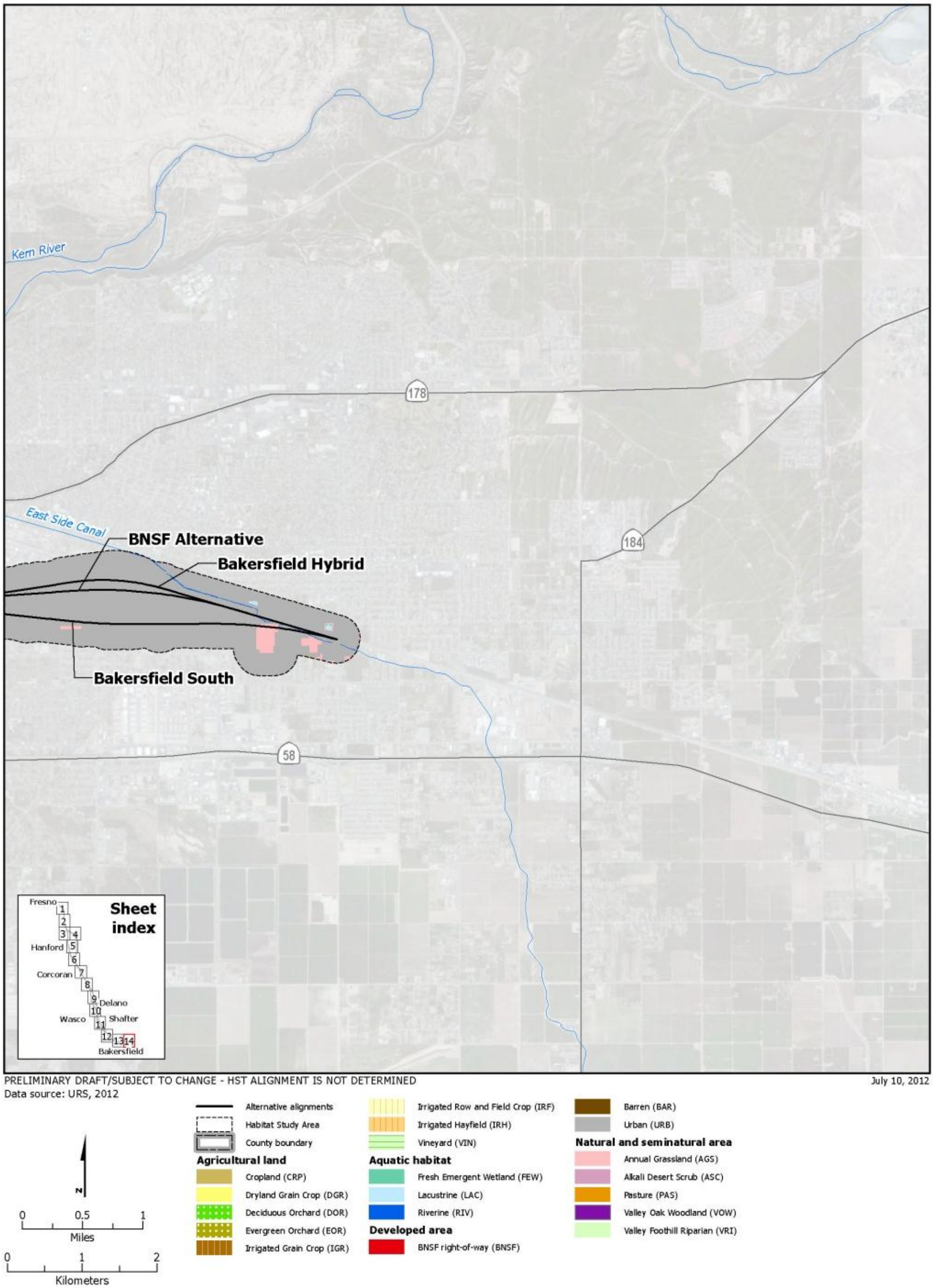



**Figure 4-6**
Wildlife habitat types (Sheet 14)

Ruderal and ornamental plant species, which are generally composed of non-native species, are dominant in all developed areas, particularly where land use was in transition and bare ground had recently been revealed, such as by roadsides, in median strips, and in vacant lots. Vegetation in these areas is highly variable, but generally includes non-native grass species, including ripgut bromes, wild oats, Italian ryegrass, and smooth barley, and weedy forbs, including bur clover, redstem filaree, yellow star thistle, Italian thistle (*Carduus pycnocephalus*), black mustard, rape mustard, white goosefoot (*Chenopodium album*), stinking goosefoot (*Chenopodium vulvaria*), and silver-leaf horsenettle. Escaped ornamentals in these areas often include oleander (*Nerium oleander*), elms (*Ulmus* spp.), bachelor's buttons (*Centaurea cyanea*), spotted knapweed (*Centaurea maculosa*), butterfly bush (*Buddleja davidii*), Athel tree (*Tamarix aphylla*), tree tobacco (*Nicotiana glauca*), and Himalayan blackberry (*Rubus armeniacus*).

**Barren**

Barren areas are defined by the permanent absence of vegetation. Areas mapped as barren during the field survey include areas of bare earth resulting from industrial activities such as gravel extraction. Barren habitats support few native wildlife or plant species, though rock dove (*Columba livia*), Brewer's blackbird (*Euphagus cyanocephalus*), killdeer (*Charadrius vociferus*), and western fence lizard (*Sceloporus occidentalis*) were observed in barren areas during the field surveys.

**Urban**

Urban areas include municipalities; industrial, residential, and agricultural structures (e.g., feedlots, poultry farms); and adjacent dedicated areas, such as yards, roads and road shoulders, highways, parking lots, and stockpiles. Both adaptive native species and non-native wildlife species occur in urban centers of the study area. Within urban areas, mapped wetland features such as ditches and seasonal wetlands are present. In Bakersfield, special-status species like the San Joaquin kit fox (*Vulpes macrotis mutica*) have also become acclimated to developed urban areas (CDFG 2012).

**BNSF Urban**

The BNSF Railway right-of-way travels the length of the Central Valley in a north-south direction, extending south from Fresno through Hanford and paralleling SR 43 from north of Corcoran to the town of Greenacres, just west of Bakersfield. In general, the BNSF Railway right-of-way is 50 feet wide and the rail tracks are set on an embankment that is a minimum of 5 feet above the surrounding grade. The embankment is constructed of compacted soil and imported gravel fills. Numerous culverts bisect the base of the berms for drainage purposes. Crossings of larger drainages exist as freestanding bridges. Most road crossings of the BNSF Railway right-of-way consist of at-grade crossings that allow vehicles to drive over the berms and tracks.

For the purposes of this analysis, all developed lands (e.g., crop, urban) in the BNSF Railway right-of-way were mapped under the BNSF urban classification. All areas of developed habitats (e.g., urban) in the right-of-way are controlled by the BNSF Railway, which retains the right to modify land use (e.g., remove orchard trees or structures). All riverine, canal, and natural upland habitats (i.e., annual grassland, alkali desert scrub, and valley foothill riparian) in the BNSF Railway right-of-way were mapped as such, not as BNSF Railway right-of-way.

At any given point along the BNSF Railway right-of-way, wildlife use is largely determined by adjacent habitats. However, in areas dominated by frequent soil disturbance, especially cropland habitats, the railroad berms may provide habitat for burrowing animals. The BNSF Railway right-of-way contains mapped wetland features such as seasonal wetlands and vernal pools.

#### 4.2.1.3 Semi-Natural Areas

The term *semi-natural* is used to distinguish the land uses described in the previous sections from plant communities where current human influences only moderately influence the plant composition and structure. Although the semi-natural plant communities have been altered to some extent by past and present human activities, the composition and structure of these communities are generally not actively managed or controlled.

**Pasture**

Pastures are actively grazed fields associated with private property. Generally, these areas contain a mix of annual grasses, such as bromes, barley, oats, and annual fescues, with other herbaceous species. Typically, these areas are actively grazed by cattle or horses but not irrigated. These areas provide some potential to support special-status wildlife species and limited potential to support special-status plant species because of the high level of disturbance.

#### 4.2.1.4 Natural Areas

The term *natural* is used to distinguish the land uses and semi-natural plant communities from plant communities where current human influences do not significantly influence the plant composition and structure. These natural areas could potentially support the life history requirements of special-status species that may be present in the study area. Natural areas are largely fragmented in the study area and may have experienced some alteration by past human activities; these characteristics reduce the potential of these areas to support special-status species. However, the composition and structure of these communities are generally not actively managed or controlled. This subsection provides descriptions for these special natural areas.

**Alkali Desert Scrub**

Alkali desert scrub vegetation in the study area is dominated by shrublands with understory cover of herbs and forbs and by vernally inundated or saturated areas lacking a shrub layer (vernal pools). These latter areas are characterized by herbs and forbs interspersed with barren, vernally inundated, or saturated alkali patches. Primary plant species observed during the various surveys included spinescale saltbush (*Atriplex spinifera*), cattle saltbush (*Atriplex polycarpa*), iodine bush (*Allenrolfea occidentalis*), goldenbush (*Isocoma acradenia*), and bush seepweed (*Suaeda moquinii*).

Alkali desert scrub supports a wide variety of wildlife species, including special-status species such as the blunt-nosed leopard lizard (*Gambelia sila*), the San Joaquin kit fox, the Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), and coast horned lizards *(Phrynosoma blainvillii*). Many wildlife species found in this habitat type are burrowers or burrow-dependent species, such as the western burrowing owl, western spadefoot toad (*Spea hammondii*), American badger, foxes (*Vulpes* sp.), coyote (*Canis latrans*), California ground squirrel (*Spermophilus beecheyi*), and a variety of kangaroo rats (*Dipodomys* spp.) species.

In the study area, this habitat is concentrated in the vicinity of Allensworth in relatively undisturbed areas. This community is fragmented throughout the region by agricultural land uses, linear infrastructure, and urban areas. Many natural areas have been converted to intensive agriculture land uses over the past 10 years.

**Annual Grassland**

Annual grasslands in the study area are typically characterized by non-native annual grass species. Dominant non-native grass species include several species of bromes, fescue (*Festuca* spp. and *Vulpia* spp.), oats (*Avena* spp.), and barley (*Hordeum* spp.). Native species, including goldfields and owl's clover (*Castilleja* spp.), may be present in annual grasslands, but typically in lower densities. Annual grasslands in the study area have typically experienced some level of past disturbance associated with various agriculture practices, row cropping, or grazing. Although these areas typically have a history of disturbance, they continue to provide suitable habitat for a number of special-status plant and wildlife species.

**Valley Oak Woodland**

Valley oak woodland in the study area is along the floodplain of the Kings River and associated sloughs and side channels in the area of the Hanford West Bypass alternatives. This habitat is characterized by well-spaced stands of mature valley oak (*Quercus lobata*) with little or no sub-canopy and a well-developed herbaceous layer. Dominant herbaceous species include brome, annual fescues (*Vulpia* spp.), oats (*Avena* spp.), and barleys. Other herbaceous plants, including soap root (*Chlorogalum pomeridianum*), filaree, miner's lettuce, prickly ox-tongue (*Picris echioides*), and spiny sow thistle (*Sonchus asper*), may be present. In the study area, valley oak woodland abruptly transitions to developed areas such as cropland or orchard.

Valley oak woodland provides food, cover, nesting sites, and dispersal habitat for a wide variety of special-status wildlife species, including Swainson's hawk.

**Valley Foothill Riparian**

Valley foothill riparian biological communities in the study area are along the riparian corridors and associated floodplains or terraces of the Kings River, Cross Creek, Tule River, Deer Creek, Poso Creek, and Kern River and along their associated sloughs and side channels. These areas are characterized by tall trees, including Fremont cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and valley oak. Subcanopy trees include white alder (*Alnus rhombifolia*) and ash (*Fraxinus* sp.). Understory shrubs and herbaceous species typically include California blackberry *(Rubus ursinus)*, elderberry (*Sambucus* sp.), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), willows (*Salix* spp.), rushes (*Juncus* spp.), mugwort (*Artemisia douglasiana*), poison hemlock (*Conium maculatum*), and stinging nettle (*Urtica dioica* ssp. *holosericea*). In the study area, an abrupt transition from valley foothill riparian vegetation to cropland or orchard results in narrow bands of riparian vegetation.

Valley foothill riparian habitat provides food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife. Riparian vegetation also supports physical and biological processes, including temperature regulation and valuable aquatic food web services (inputs for nutrient cycling and food availability). Protected insects like the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) are native to these habitats (Mayer and Laudenslayer 1988). Several sensitive natural communities overlap with this habitat type, including valley oak woodland, Fremont cottonwood forest, Goodding's willow thickets, and red willow thickets.

## 4.2.2 Aquatic and Riparian Resources

A number of jurisdictional waters were identified in the study area, including wetlands, other waters of the U.S., and riparian areas (Figure 4-7). Identified wetland features include seasonal wetlands, emergent wetlands, and vernal pools and swales. Other waters of the U.S. identified in the study area include canals/ditches, lacustrine, and seasonal riverine. Additionally, riparian areas, that are generally found in association with seasonal riverine features, were identified and are discussed with aquatic resources because of the important functions they provide that affect water quality, including groundwater recharge, surface water supply, nutrient cycling, water filtration, temperature control, maintenance of plant and animal communities, sediment transport and storage, stream channel dynamic equilibrium, and streambank stabilization.

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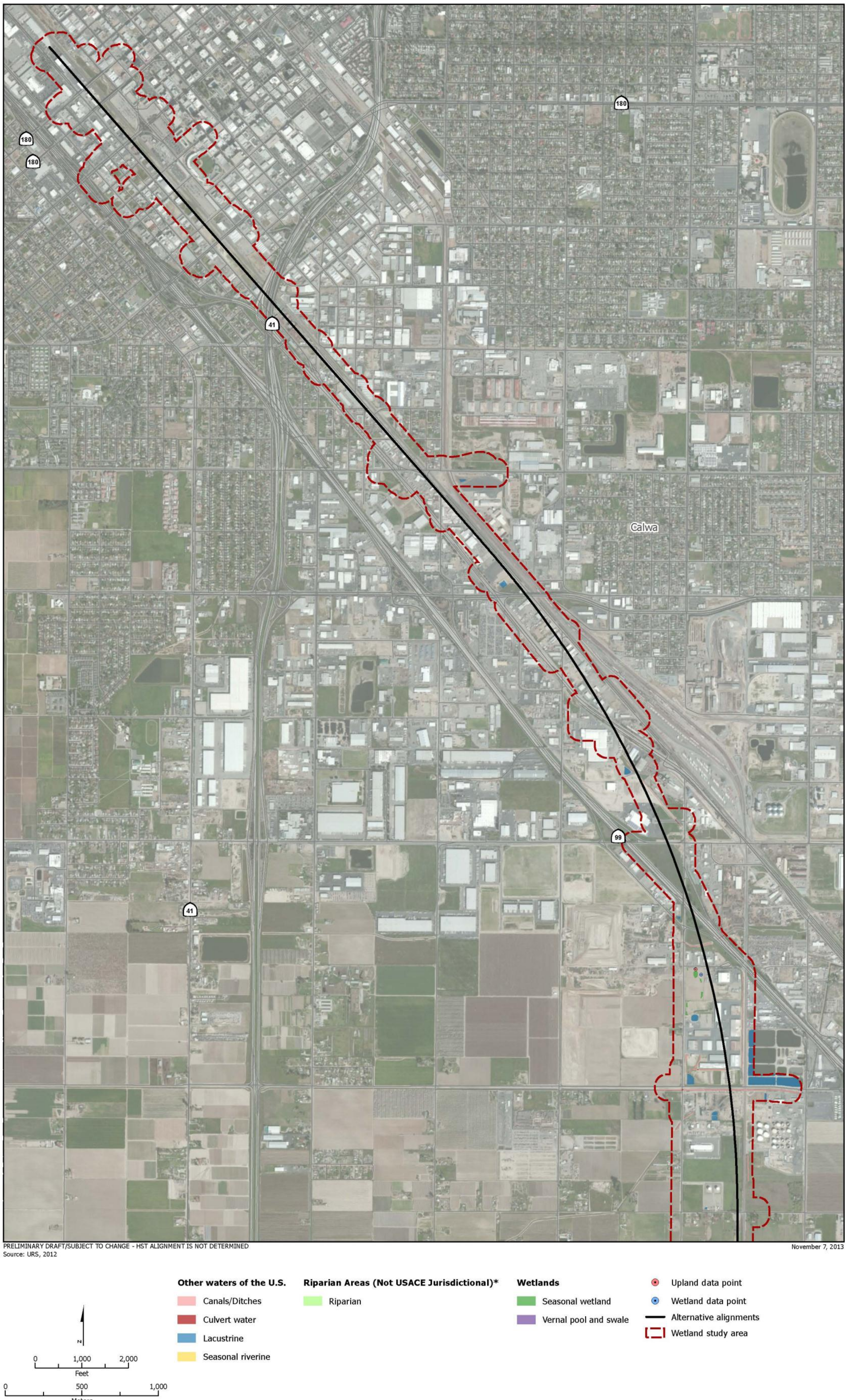



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 1 of 33)

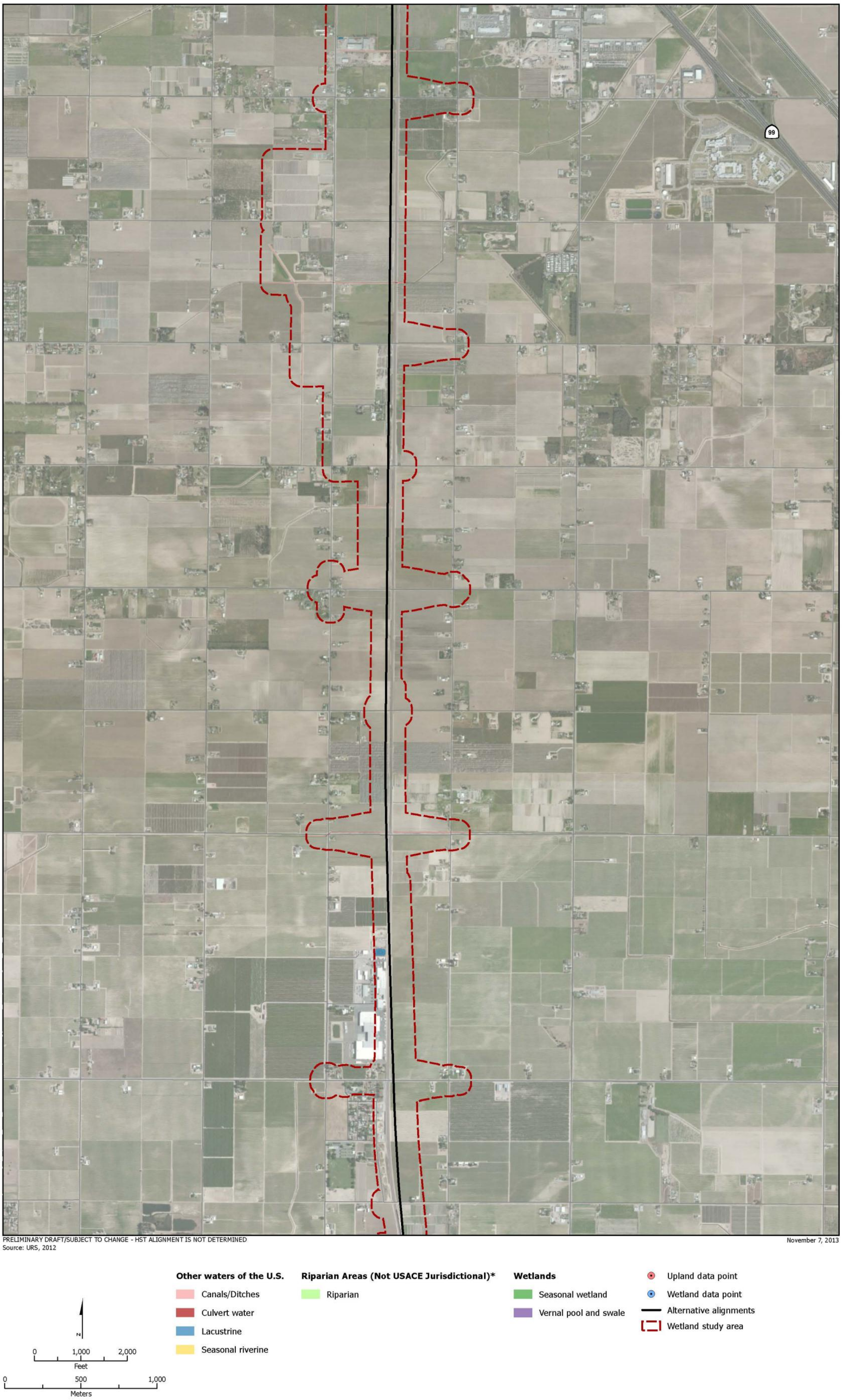



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 2)

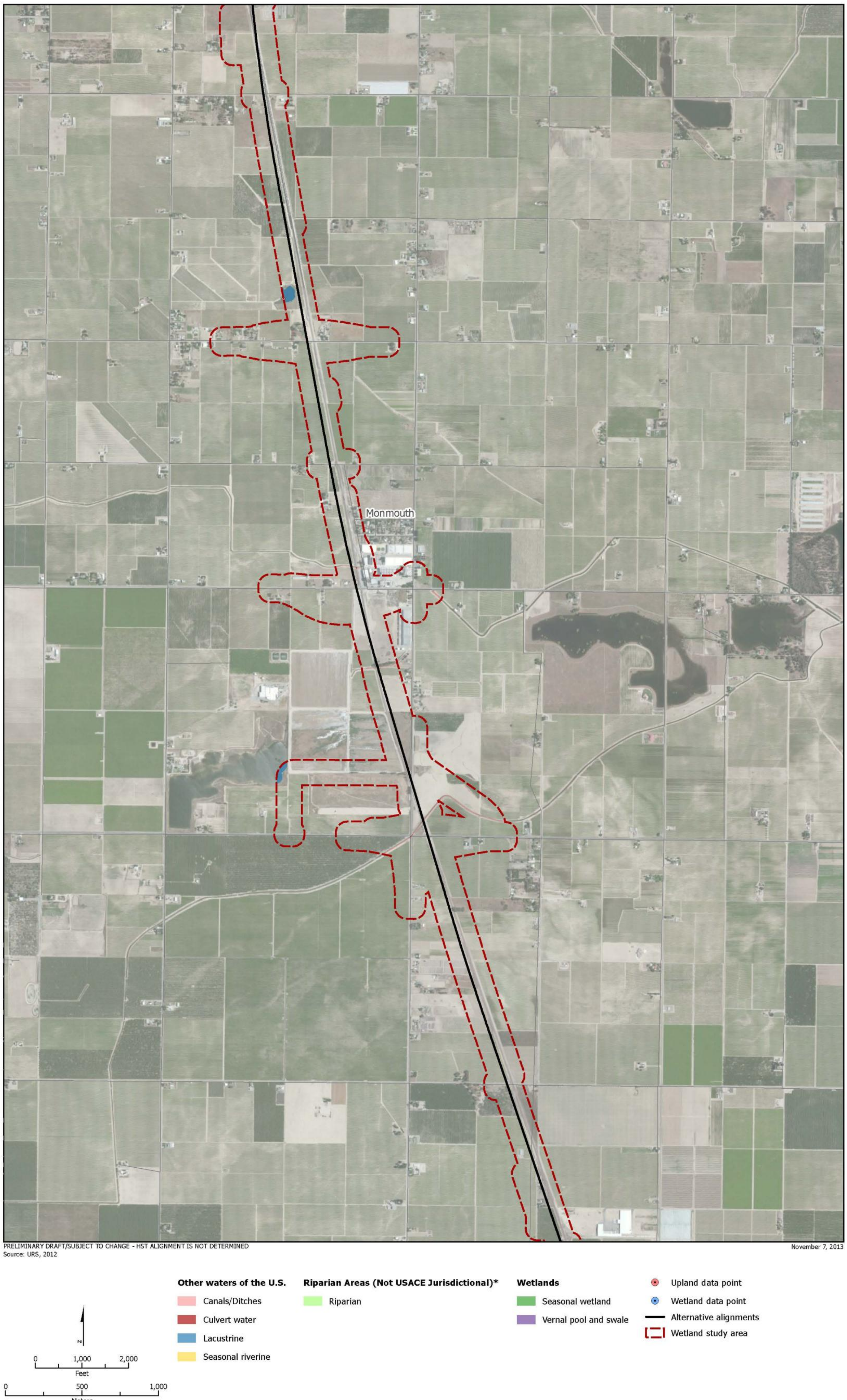



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 3)

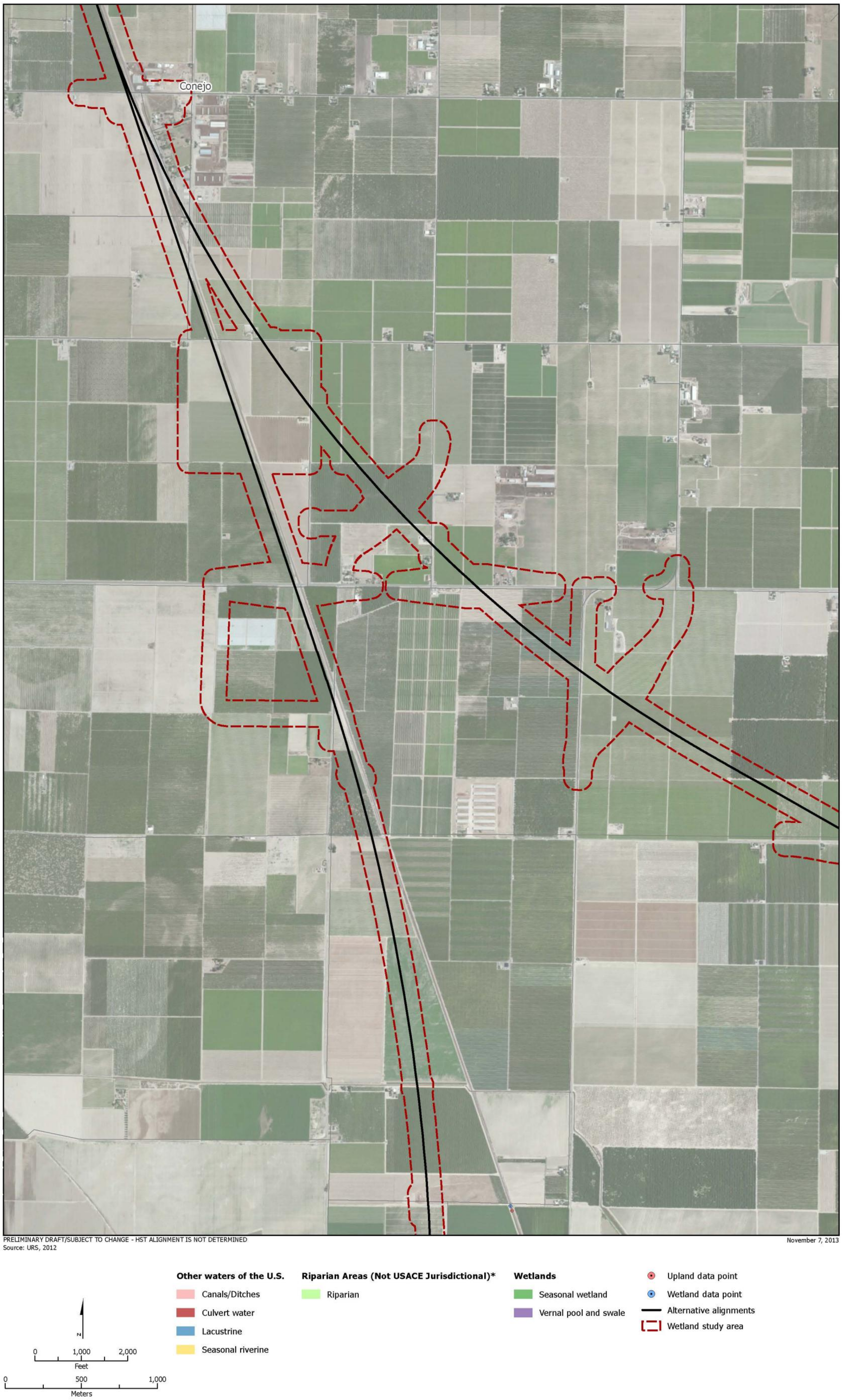
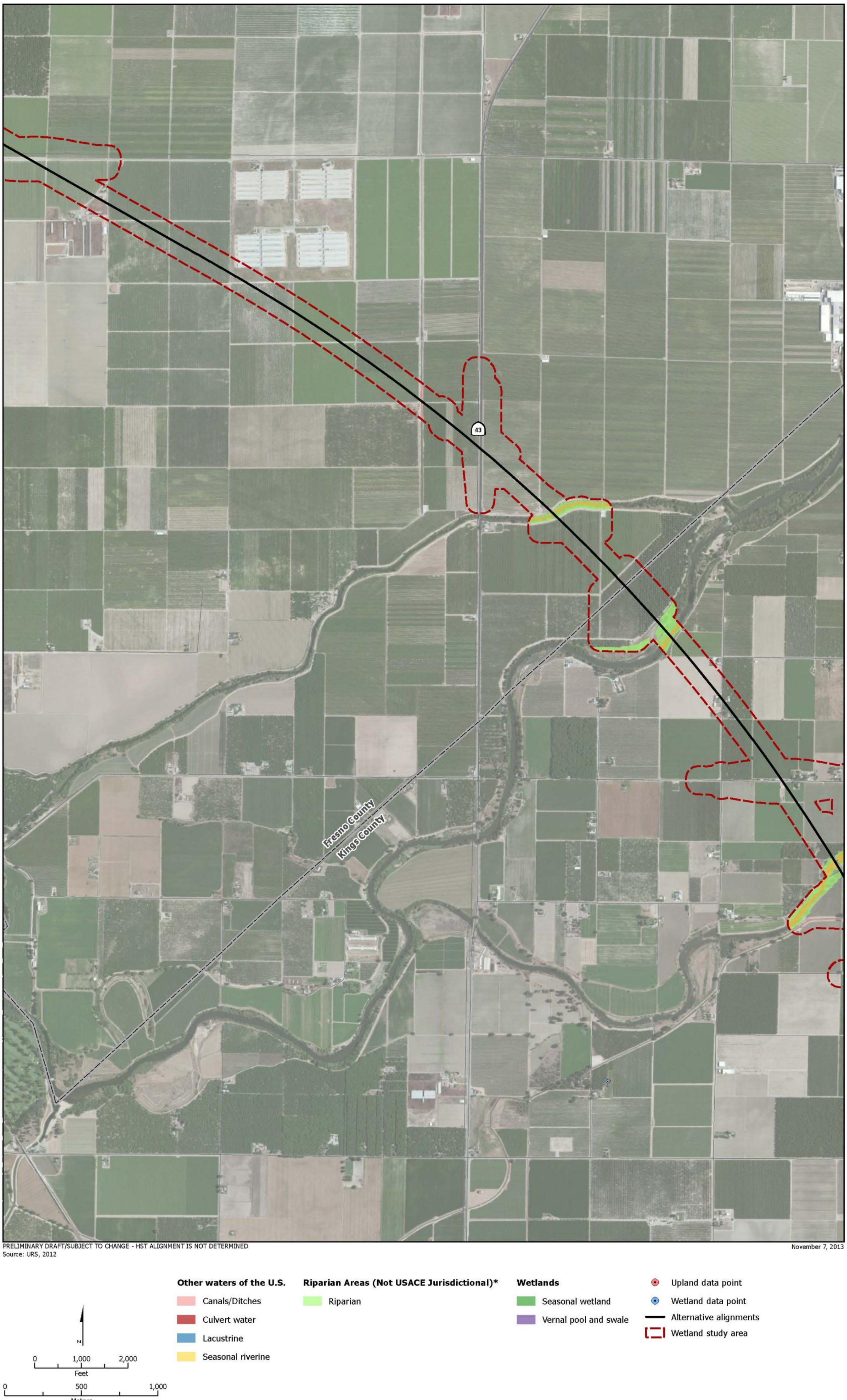



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 4)

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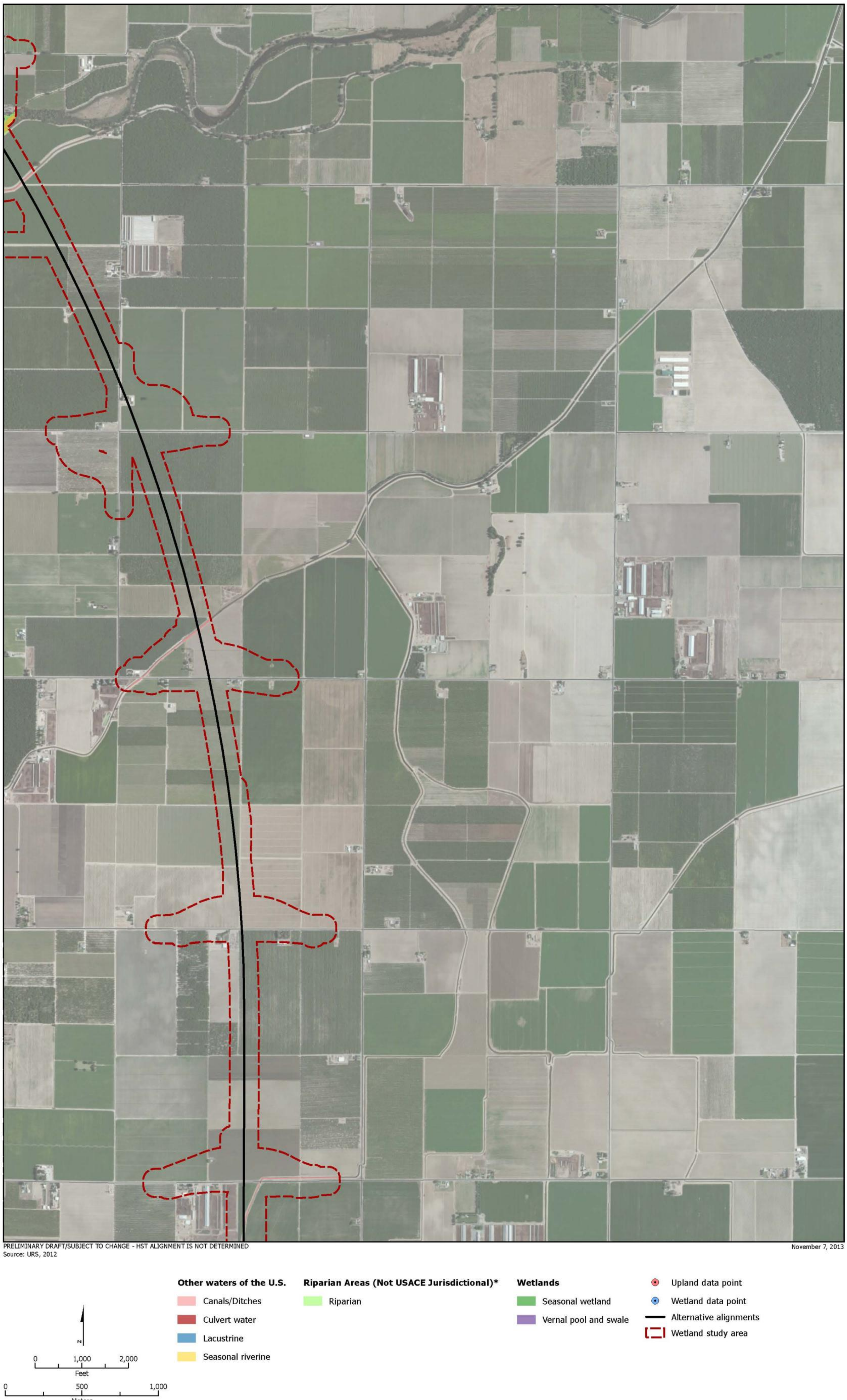


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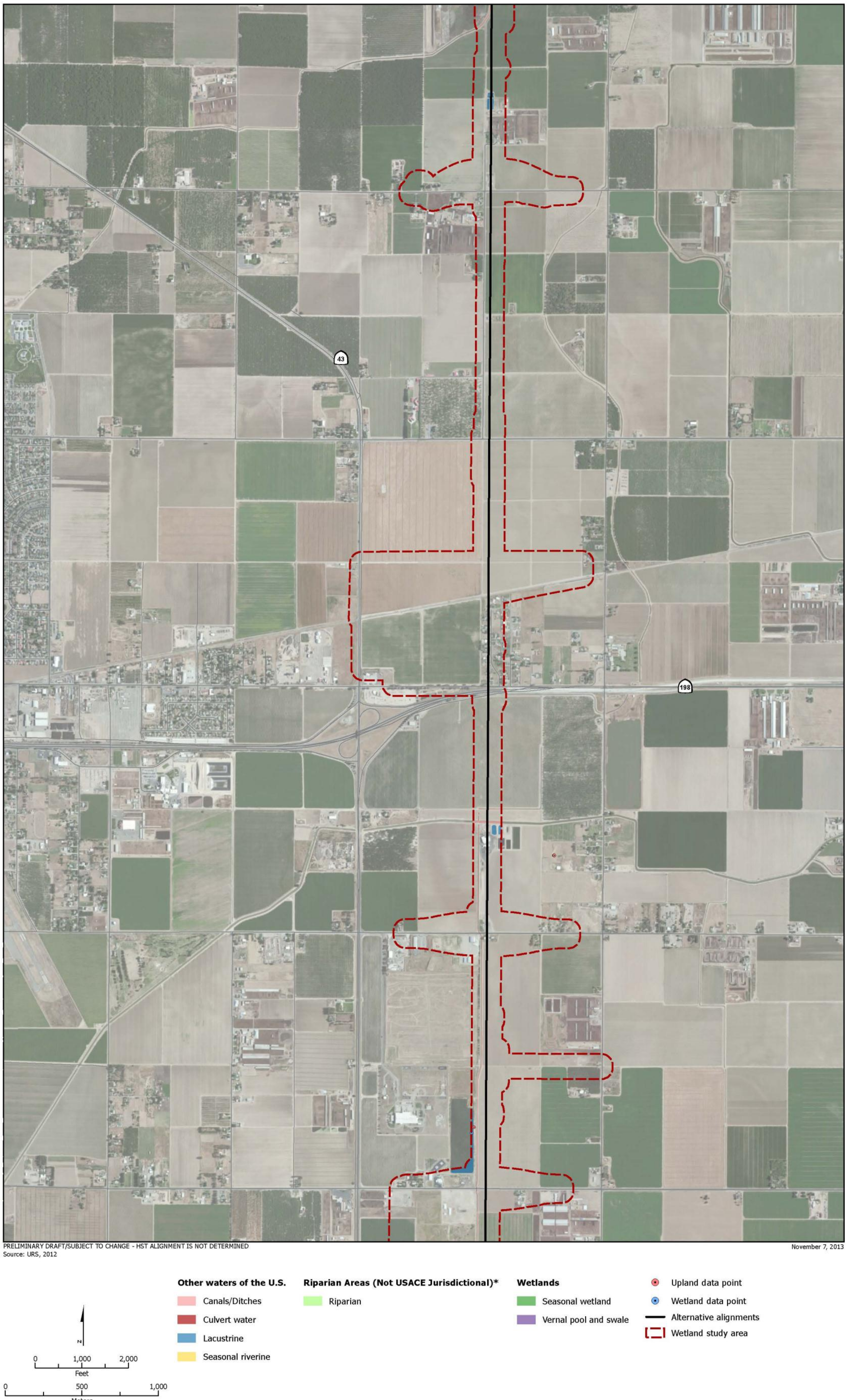



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 7)


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 8)

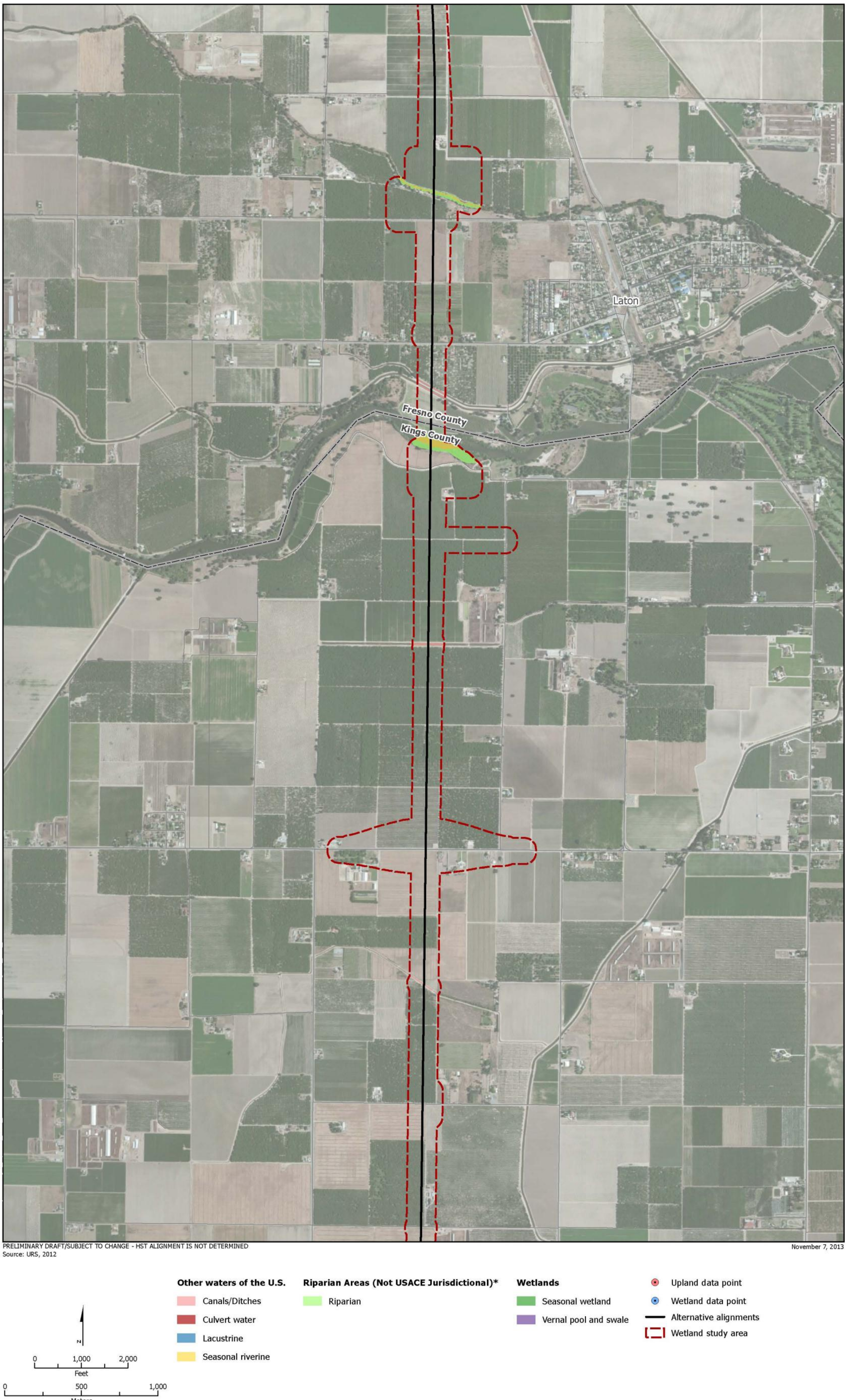
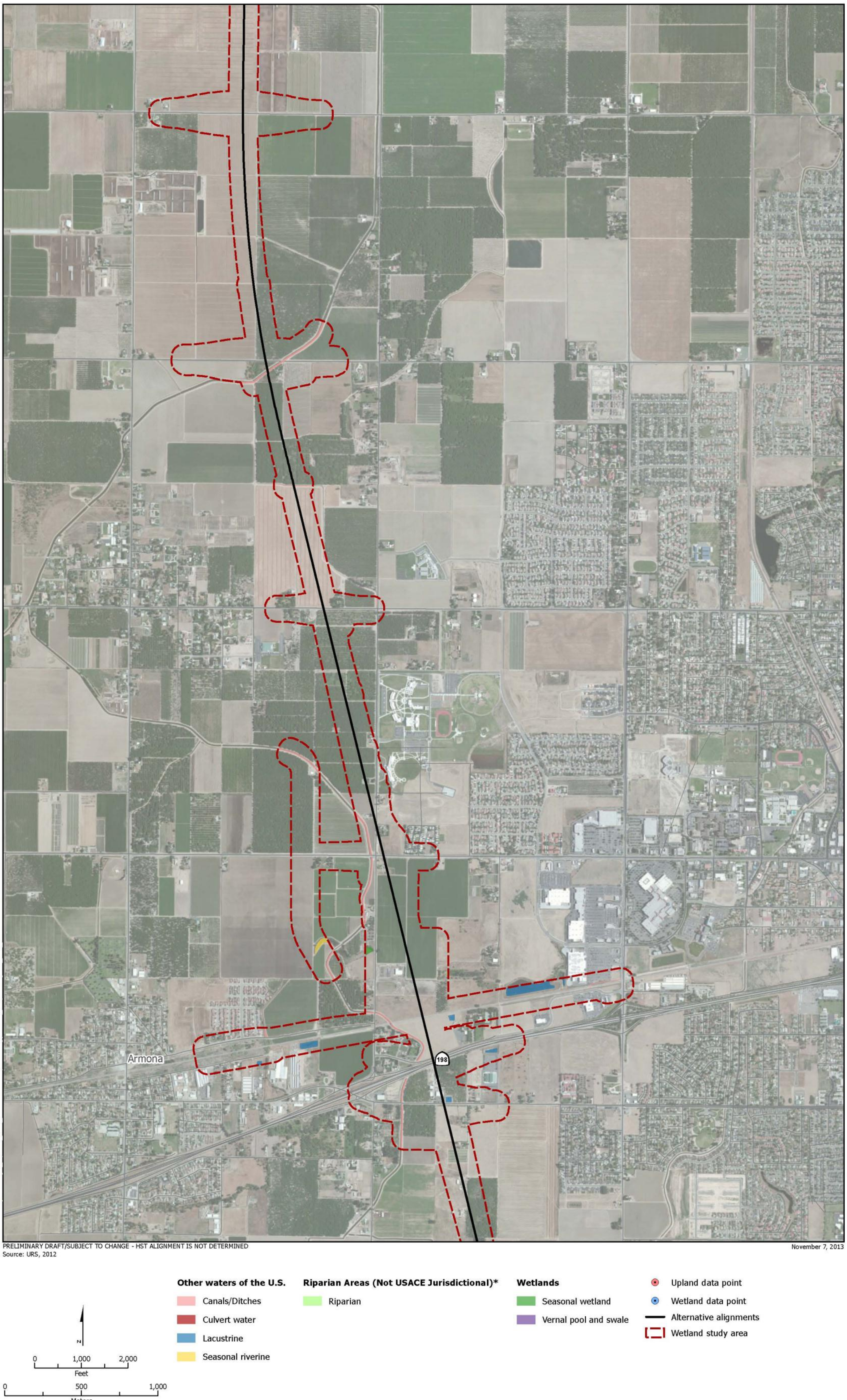



**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 9)

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Jurisdictional waters delineation and riparian areas (Sheet 10)

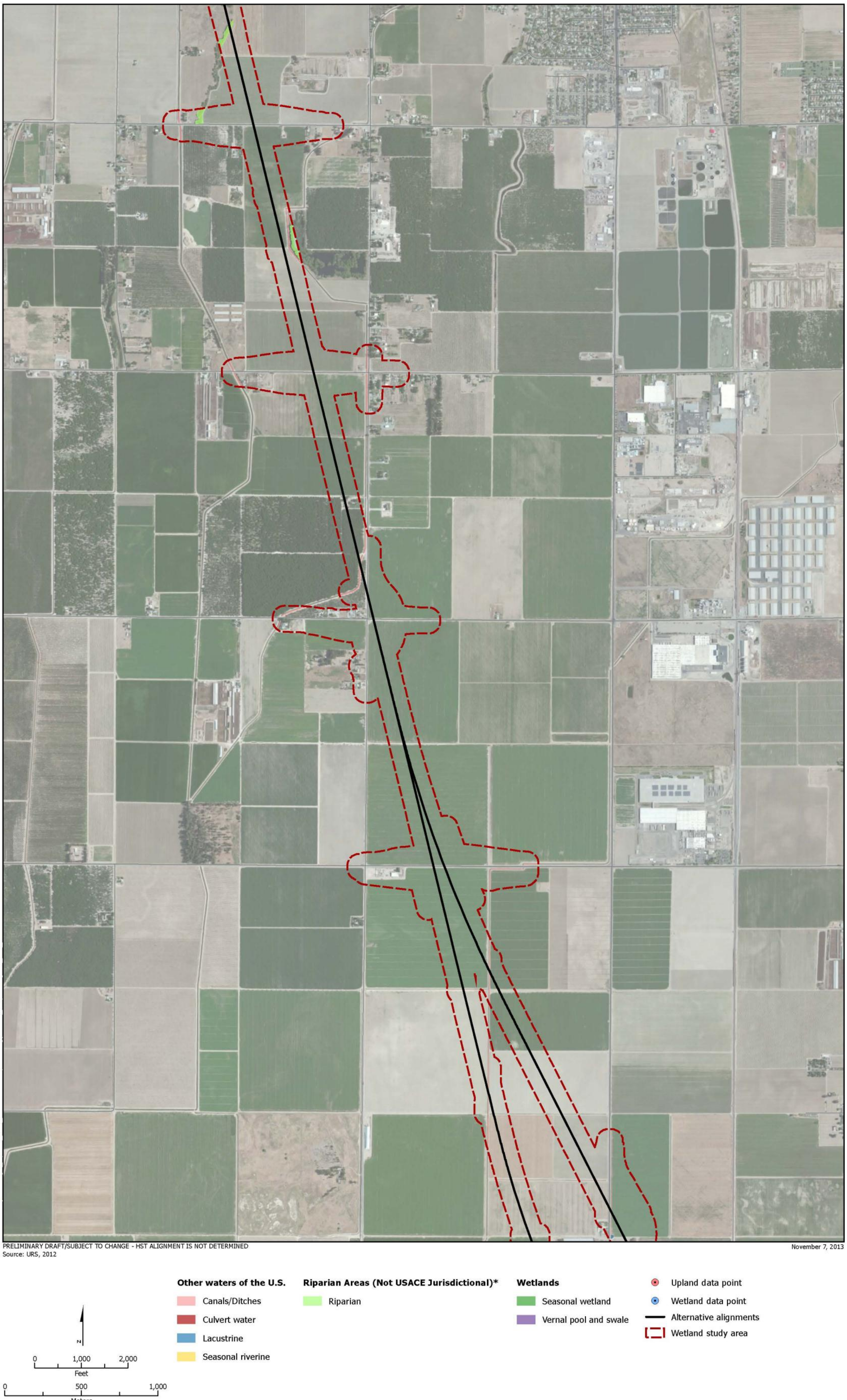


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 11)


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 12)


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 13)

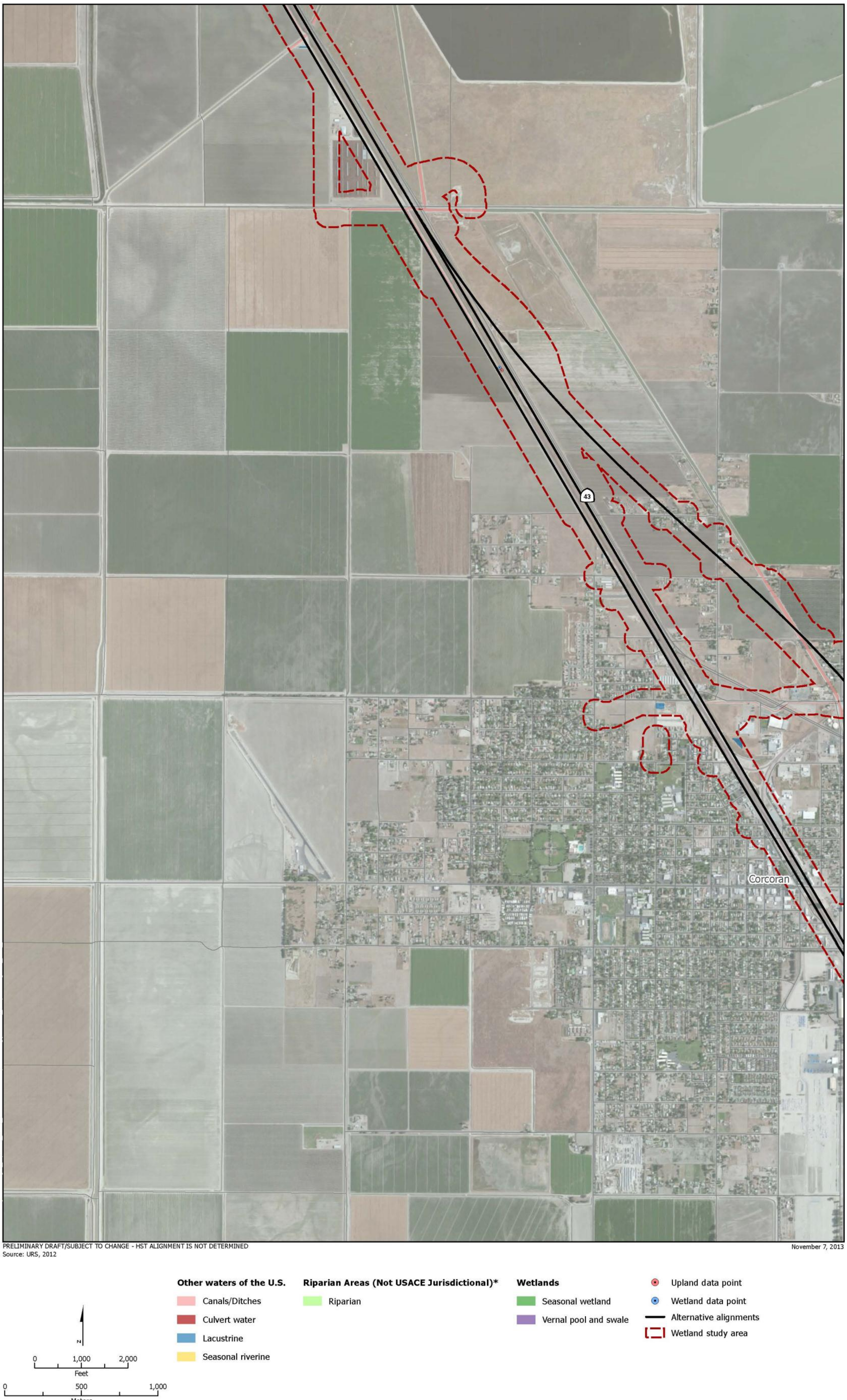


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 14)

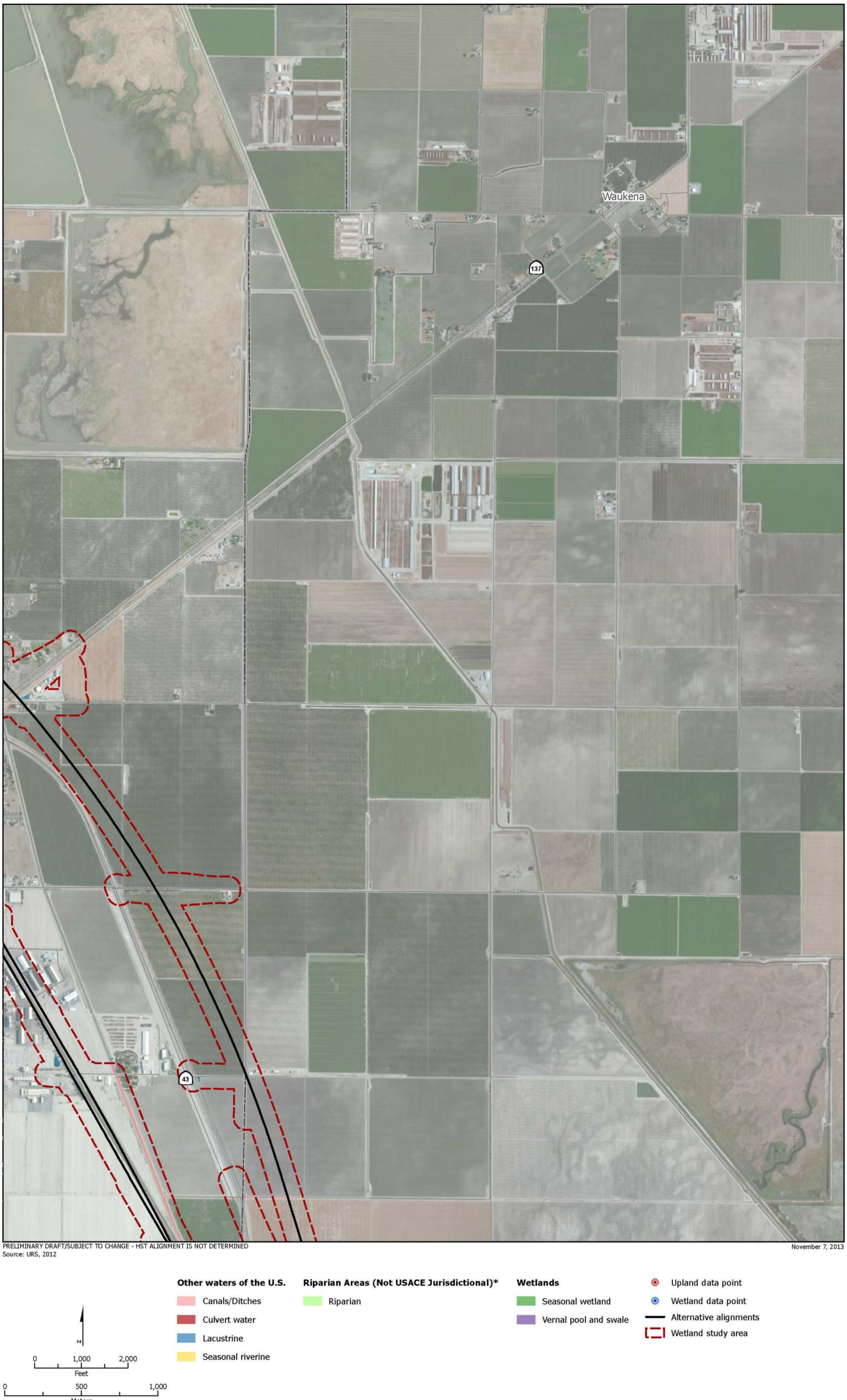


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 15)

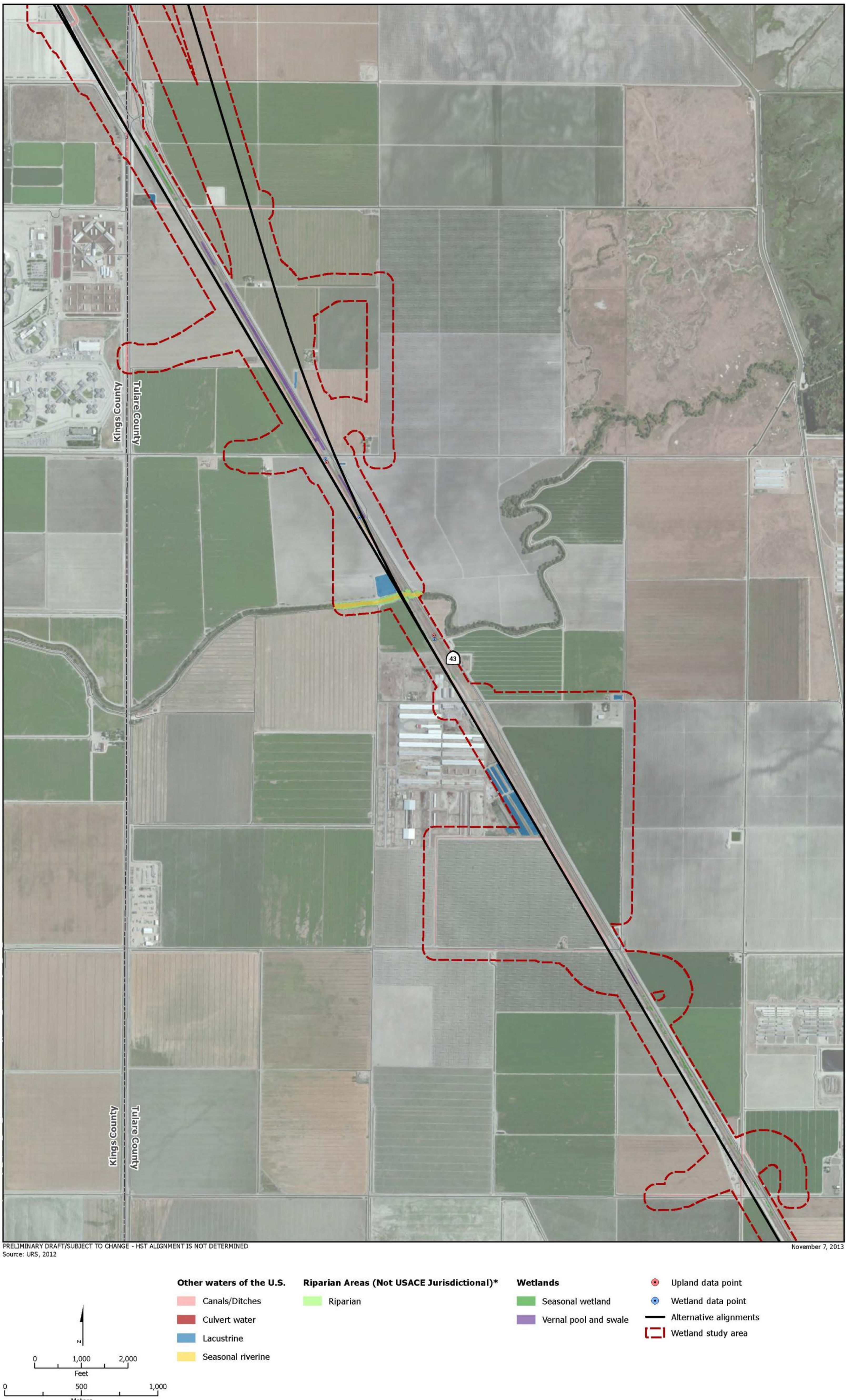


**Figure 4-7**
Jurisdictional waters delineation and riparian areas (Sheet 16)